PREFACE

This manual was assembled with the service person and technician in mind. Our objective was to give procedures and guidelines for efficient and successful fuel pump installation and service. Many technical manuals contain the necessary information; finding it is the problem.

This manual is dividend into four major sections:

Sales- What models to use and how they are identified.

Installation- How to install the model selected.

Piping- Good practice piping installations and how to cope with non-recommended piping found in previous installations.

Service- How to test and service new and existing installations.

We have addressed situations found in the field which are not good practice, but since they have been in use, we must contend with them.

If you have problems which you cannot answer, please contact Suntec's field service department at 800-367-7116. We, at Suntec, appreciate your support and look forward to many more years of working with you.

TABLE OF CONTENTS

SALES

FUEL UNITS

Model A Single-Stage I-1
Model B Two-Stage I-3
Model B Two-Stage, Two-Step I-5
Model B Special Pressures I-5
Model J Single-Stage I-6
Model H Two-Stage I-8

VALVES

Models R and C Solenoid I-10

INSTALLATION

FUEL UNITS

Model A Single-Stage II-1
Model B Two-Stage II-1
Model A Single-Stage, Two-Step II-7
Model B Two-Stage, Two-Step II-7
Model B Special Pressures II-7
Model J Single-Stage II-12
Model H Two-Stage II-12

OTHER PUMPS

Model A Waste Oil II-20
Model J Waste Oil II-20
Boost Pumps and Central System II-23

PIPING

Single-Pipe III-1
Gravity Feed III-2
Lift Feed III-3
Two-Pipe III-3
Gravity Feed III-5
Lift Feed III-6

LINE SIZING

Single-Pipe . . . . . See Specific Model Installation
Two-Pipe III-7
Adding Additional Units III-8
Priority Controls III-9
Multiple Units with Manifold Piping
  Gravity Feed III-10
  Lift Feed III-11
Check Valves III-12
Thermal Expansion III-12

SERVICE

Routine or Annual Checkout IV-1
Trouble Call IV-1
System Troubleshooting Sequence IV-2
Troubleshooting Guide for Fuel Pump IV-4
Testing Fuels Units and Systems IV-7
  Vacuum Test - Fuel Units IV-7
  Vacuum Test - System IV-9
  Pressure Test IV-10
  Operating and Cutoff Test IV-11
Strainers and Field Service IV-12
Filters and Filtration IV-15
Solenoid Valves and Field Service IV-17

SUNTEC
PERFORMANCE-PROVEN FUEL UNITS AND VALVES
...for residential and commercial applications

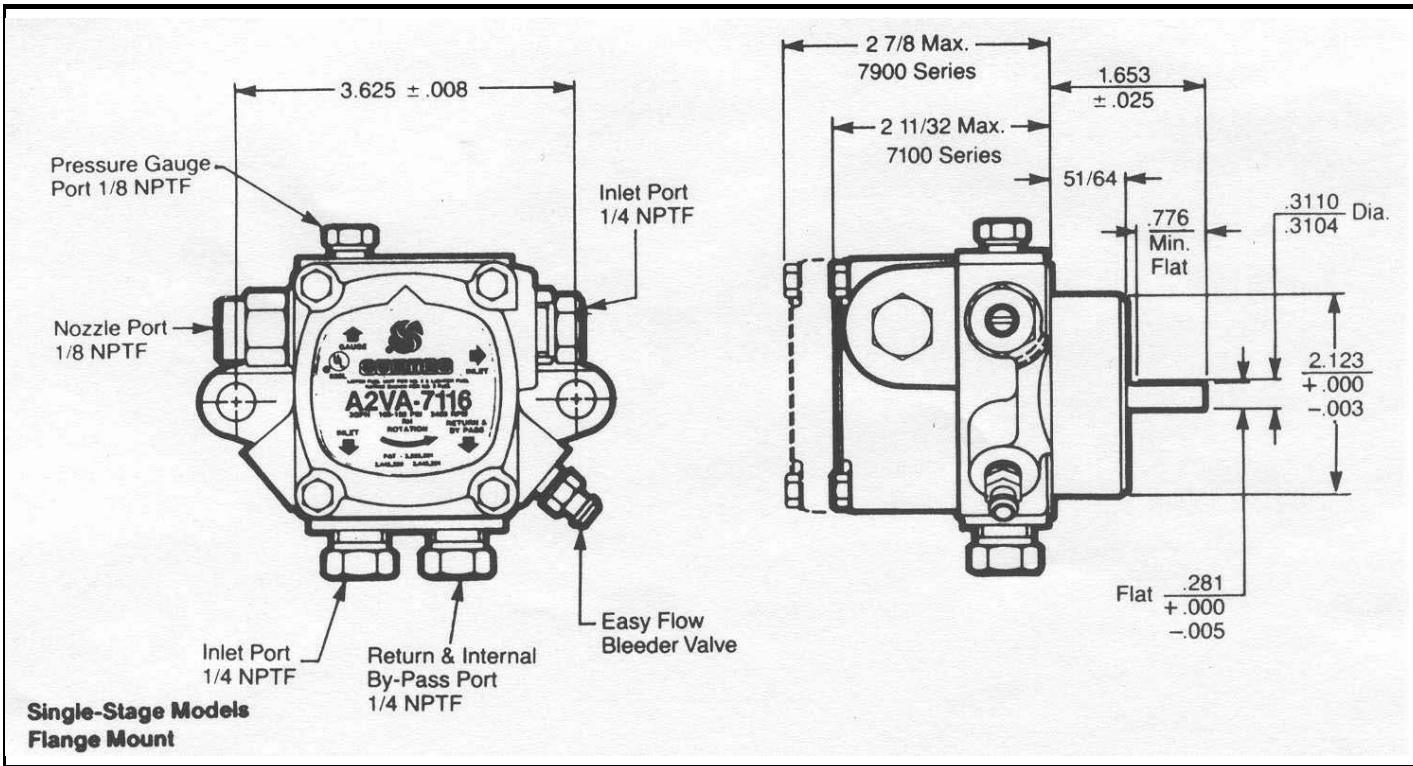
SUNTEC, THE INDUSTRY LEADERS ●
BUILT ON OUR COMMITMENT

Knowing the industry's need and responding to them with the right products and services is one of the responsibilities of leadership. Over the years, Suntec has been committed to being involved, asking questions, listening and providing answers. Today, as the industry leaders, our involvement is as strong as ever. We still work hard to earn your trust in us as the experts in our field. You shouldn't have to settle for less.

MODEL A-7000 ● *SINGLE-STAGE FUEL UNITS*

- Single-pipe installations to 6" hg. vacuum
- Two-pipe installations to 12" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Choice of 1725, 2850, 3450 rpm
- Suitable for no. 2, no. 1 fuel oil, or kerosene
- Mounting in any position
- Factory-set at 100 psi
- Adjustable range 100-150 psi at 3450 rpm, 100-135 psi at 1725 rpm. Models available to 200 and 300 psi.

SPECIFICATIONS /ORDERING INFORMATION*

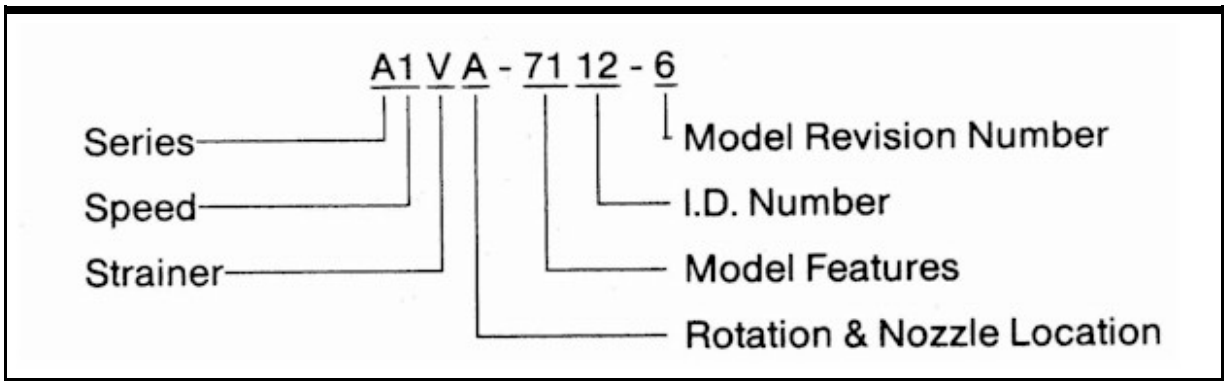


Single-Stage Models
Flange Mount

Model Number	RPM	Rotation[1]	Nozzle Port Location[1]	Strainer & Nozzle Rating at 100 psi	Special Features
A1VA-7112	1725	R.H.	R.H.	3 gph	--
A1VB-7113	1725	R.H.	L.H.	3 gph	--
A1VC-7114	1725	L.H.	L.H.	3 gph	--
A1VD-7741	1725	L.H.	R.H.	3 gph	3-bolt mtg. hub
A1YA-7912	1725	R.H.	R.H.	7 gph	--
A2VA-3006					
A2VA-7142	2850	R.H.	R.H.	2.25 gph	--
A2VA-7116	3450	R.H.	R.H.	3 gph	--
A2VB-7117	3450	R.H.	L.H.	3 gph	--
A2VC-7118	3450	L.H.	L.H.	3 gph	--
A2VA-7416	3450	R.H.	R.H.	3 gph	Solenoid dumping fuel unit
A2YA-7743	3450/2850	R.H.	R.H.	7 gph	
A2YA-7916	3450	R.H.	R.H.	7 gph	3 gph at 200 psi
A2YA-7430	3450	R.H.	R.H.	3 gph	Solenoid dumping fuel unit
A2VD-7519	3450	L.H.	R.H.	3 gph	Solenoid dumping fuel unit .32mm hub
A2RA-7710	3450/100	R.H.	R.H.	2.5/.4 gph	Waste oil application
A2RA-7736	3450/1725	R.H.	R.H.	2.5/2.5**gph	Waste oil application
A2RA-7737	3450/1725	R.H.	R.H.	2.5/2.5**gph	10-20 psi waste oil application
A1RA-7738	1725	R.H.	R.H.	2.5	Waste oil application
A2RA-7739	3450/1725	R.H.	R.H.	2.5/1.5 gph	30-50 psi waste oil

*Also apply to "-6" model numbers (shown on fuel unit).
For example: "7916-6," etc. [1]Viewed from shaft end.
**Use gage port for rated flow @ 1725 rpm, no cut off.
Note: All ports shown in diagram are reversed for left-hand nozzle fuel units.

Typical Model Number Nomenclature
(Model A & Model B):*

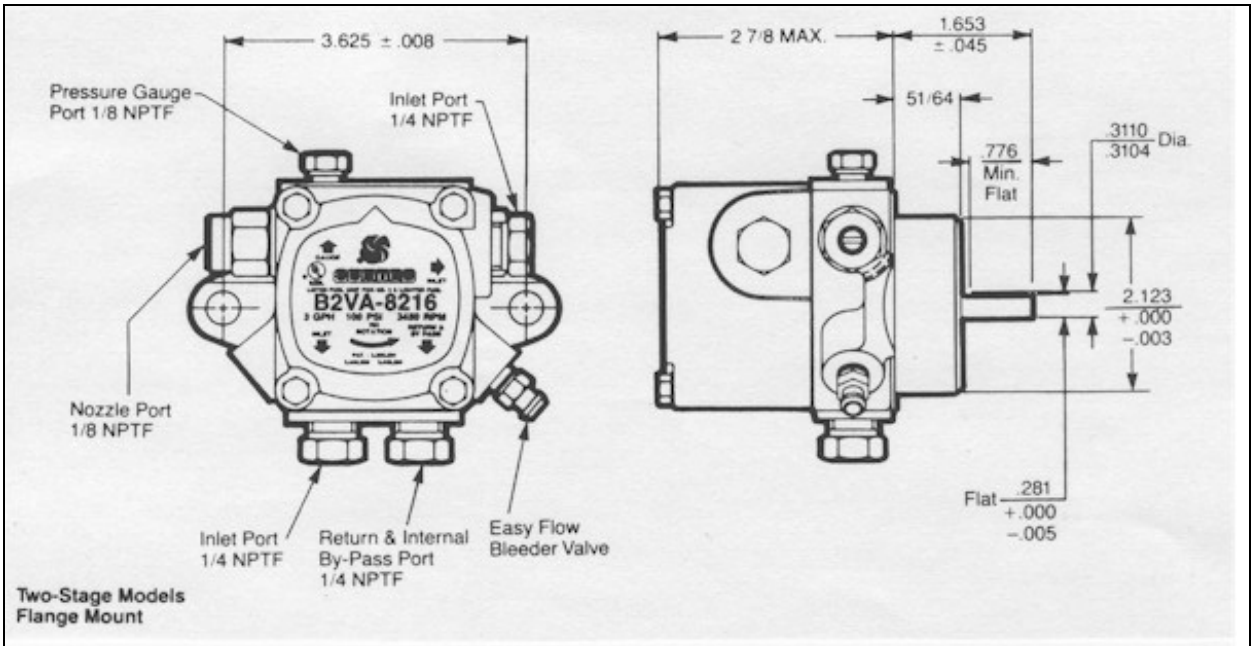


*The model number appears on the fuel unit label.

MODEL B-8000 • *TWO-STAGE FUEL UNITS*

- Two-pipe installations up to 17" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Capacities to 7 gph, except boost pumps
- Factory-set at 100 psi
- Pressure adjustable from 100 to 150 psi at 3450 rpm, 100 to 135 psi at 1725 rpm. Models available to 200 and 300 psi
- Choice of 1725, 2850, 3450 rpm
- Suitable for no.2, no.1 fuel oil, or kerosene
- Mounting in any position except upside down.

SPECIFICATION/ORDERING INFORMATION*



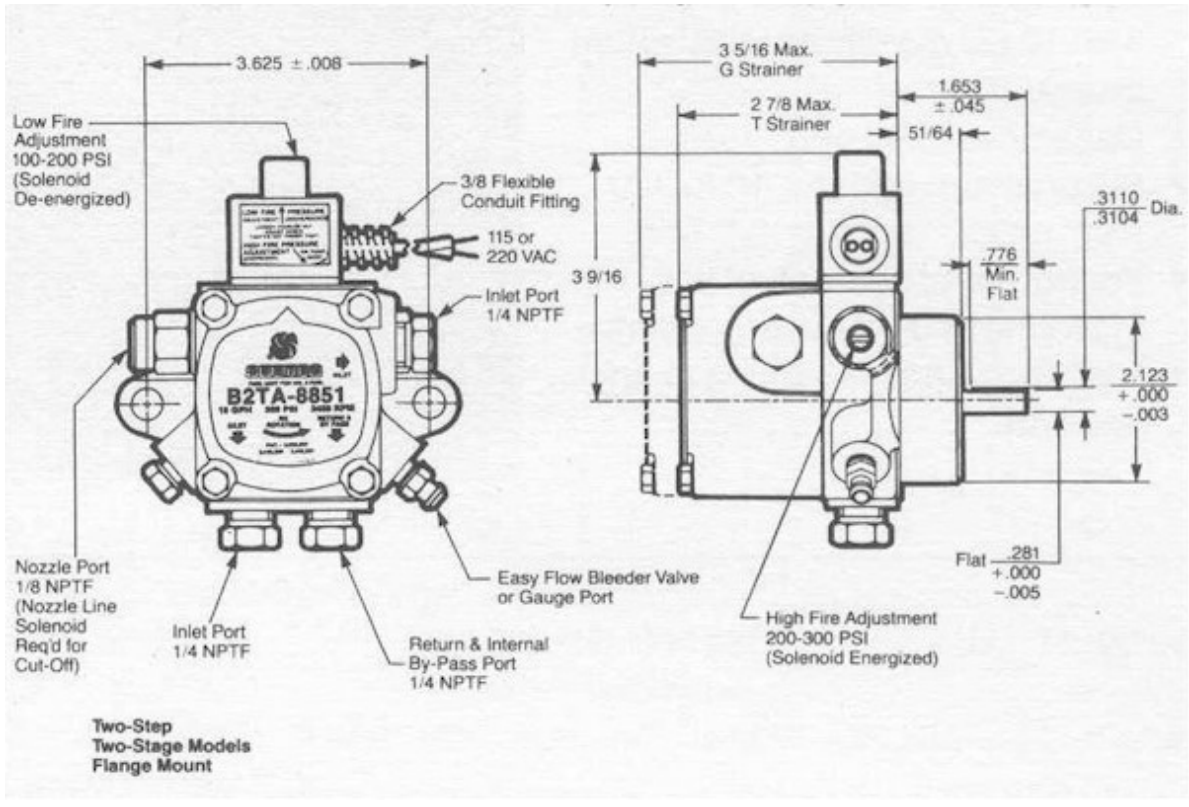
Model Number	RPM	Rotation[1]	Nozzle Port Location[1]	Strainer & Nozzle Rating at 100 psi	Special Features
B1VA-8212	1725	R.H.	R.H.	3 gph	--
B2VA-8216	3450	R.H.	R.H.	3 gph	--
B2YA-8916	3450	R.H.	R.H.	7 gph	3 gph at 200 psi
B2VA-8416	3450	R.H.	R.H.	3 gph	Solenoid dumping fuel unit
B2VA-8241	3450	R.H.	R.H.	--	Boost pump, 20 gph at 10-20 psi
B2VA-8242	2850	R.H.	R.H.	2.25 gph	--

*Also apply to "-8" model numbers (shown on fuel unit). For example: "8212-6," etc.
[1]Viewed from shaft end.

MODEL B-8200 • *TWO-STAGE HIGH CAPACITY HIGH PRESSURE (NOT PICTURED) AND*
MODEL B-8800 • *TWO-STEP TWO-STAGE*

- Two-pipe installations up to 17” hg. Vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Adjustable manual or automatic high/low firing
- High efficiency burner applications
- Capacities to 23 gph
- Pressure adjustable (100 to 200 psi low fire, 200-300 psi high fire)
- For no. 2 fuel oil. For other fuels, consult factory
- Two-bolt flange mounting in any position except upside down.

SPECIFICATIONS*/ORDERING INFORMATION

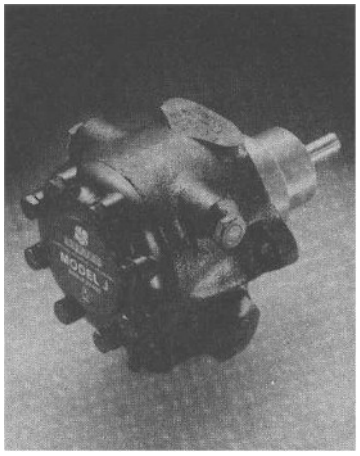


Model Number	RPM	Rotation[1]	Nozzle Port Location[1]	Strainer & Nozzle Rating at 300 psi
High-Capacity Units				
B2VA-8243	3450	R.H.	R.H.	3 gph[2]
B2TA-8245	3450	R.H.	R.H.	16 gph
B2TA-8248	3450	R.H.	R.H.	8 gph[3]
Two-Step Units				
B2TA-8850	3450	R.H.	R.H.	10 gph
B2TA-8851	3450	R.H.	R.H.	16 gph
B2GA-8852	3450	R.H.	R.H.	23 gph

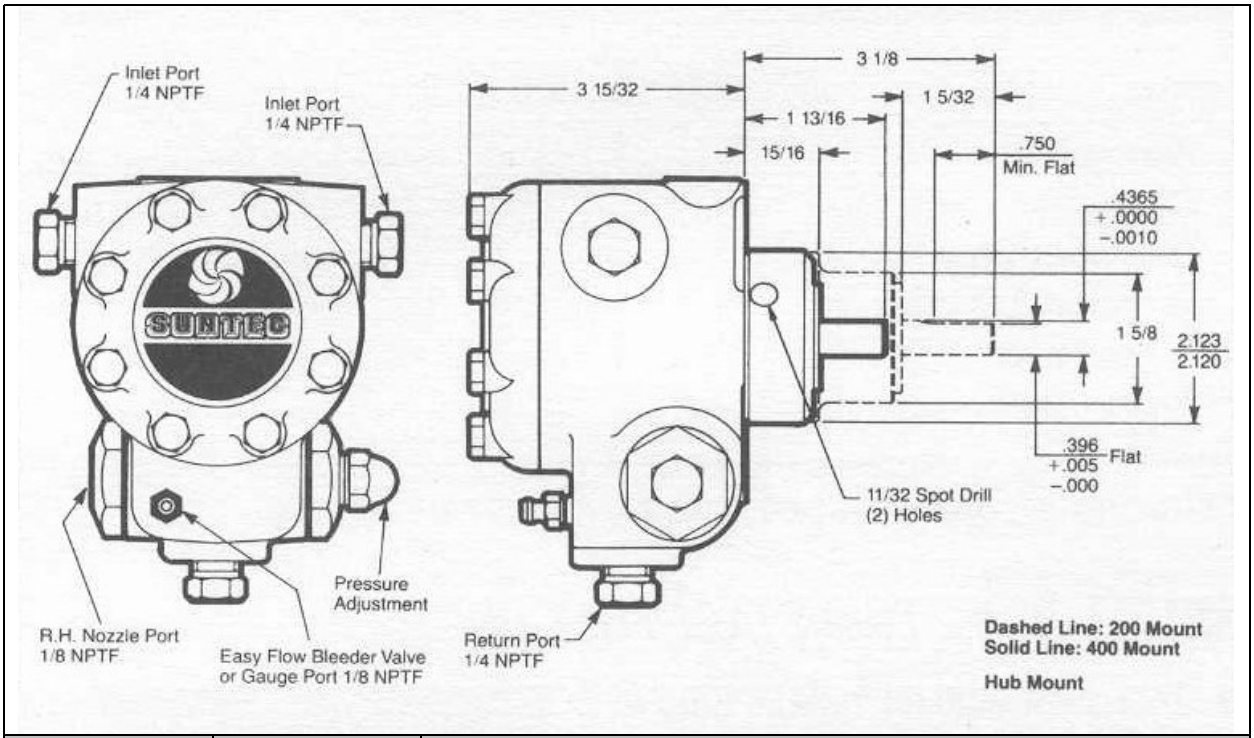
*Also apply to "-8" model numbers (shown on fuel unit). For example: "8850-8," etc.
[1]Viewed from shaft end. [2]At 130 psi. [3]At 150 psi.

MODEL J • *SINGLE-STAGE FUEL UNITS*

- Single-pipe gravity feed installations
- Two-pipe lift installations to 12" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Capacities to 60 gph
- Six pressure options, 10 to 300 psi*
- For no. 4 and lighter fuel oils (gasoline and JP fuels, special)
- Hub and flange mounting in any position.



SPECIFICATION /ORDERING INFORMATION*



Model Number[1]	Piston Type	Maximum Firing Rate* (gph)			
		1725 rpm		3450 rpm	
		100 psi	300 psi[2]	100 psi	300 psi[3]
JJ2	Std.	--	--	3	--
JA2	Std.	--	--	7	--
JB2	Std.	--	--	10	--
J2	Std.	3	--	16	--
J3	Std.	7	--	20	--
	G	8	--	24	10
	N	9	--	26	14
J4	Std.	11	--	30	17
	N	13	--	33	23
J5	Std.	17	--	40	28
	N	19	5	46	32
J6	Std.	24	7	55	40
	N	26	10	60	45

*Special Pressure Spring Choices:

A = 20-40 psi C = 150-300 psi E = 10-20 psi

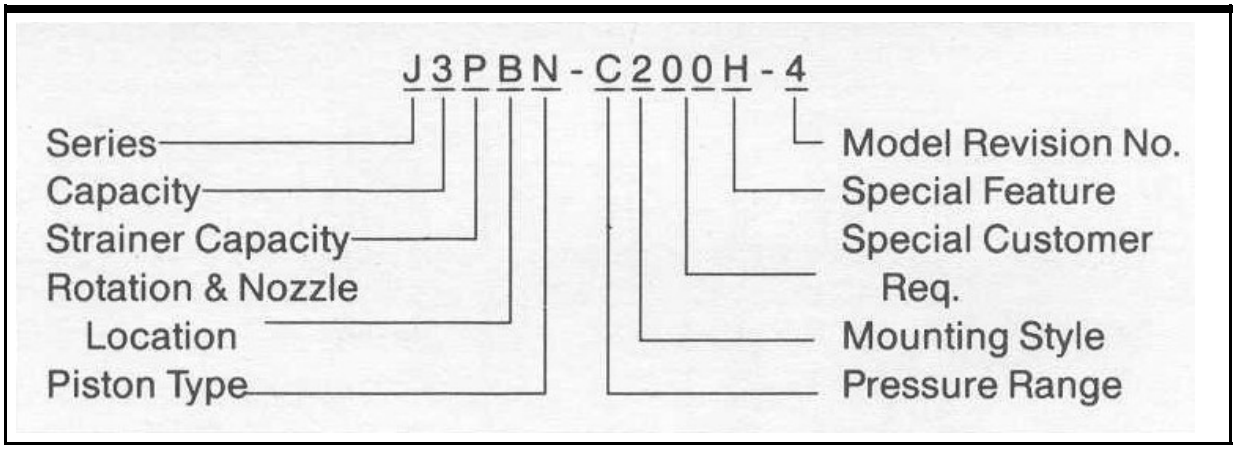
B = 75-200 psi D = 40-80 psi

[1]Do not adjust J2 and 3450 rpm-only models (JA, JB, JJ) to higher than 100 psi.

[2]Requires C spring (100-300 psi range).

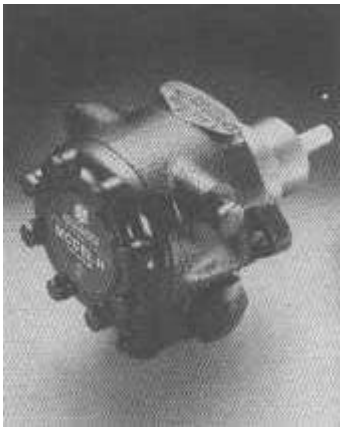
[3]Requires C spring and hardened gear.

Typical Model Number Nomenclature
(Model J & Model H):*



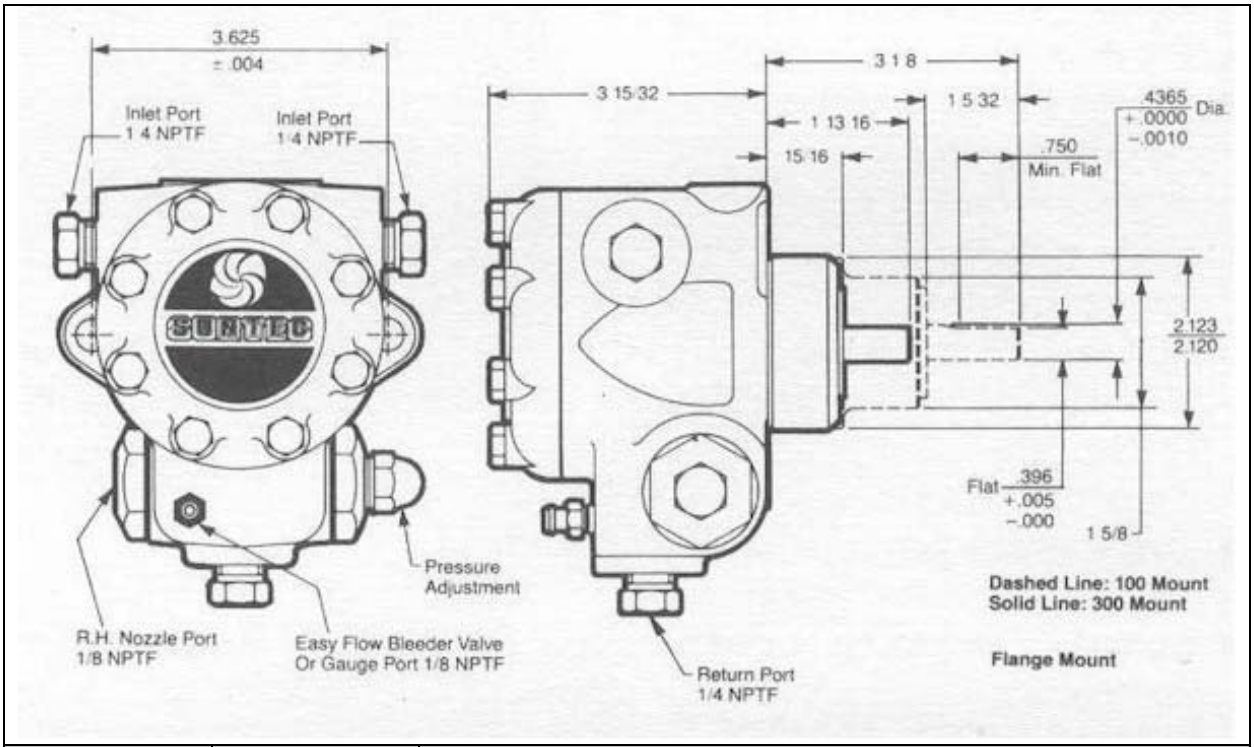
* The model number appears on the top of the fuel unit.

MODEL H *TWO-STAGE FUEL UNITS*



- Two-pipe high lift installations to 17" hg. vacuum
- Capacities to 83 gph
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Six pressure options, 10 to 300 psi*
- For no. 4 and lighter fuel oils (gasoline and JP fuels, special)
- Three hub and flange mounting options: Model H may be mounted with the valve horizontal at either the top or bottom. Valve may be mounted vertical provided the adjusting screw is at the top of CW rotation-left nozzle and CCW rotation-right nozzle models, or adjusting screw at bottom on CW rotation-right nozzle and CCW rotation-left nozzle models.

SPECIFICATIONS /ORDERING INFORMATION*



Model Number[1]	Piston Type	Maximum Firing Rate* (gph)			
		1725 rpm		3450 rpm	
		100 psi	300 psi[2]	100 psi	300 psi[3]
HA2	Std.	--	--	7	--
H2	Std.	3	--	16	--
H3	Std.	7	--	20	--
	G	8	--	24	10
	N	9	--	26	14
H4	Std.	11	--	30	17
	N	13	--	33	23
H5	Std.	17	--	40	28
	N	19	5	46	32
H6	Std.	24	7	55	40
	N	26	10	60	45
H7	Std.	40	17	--	--
	N	42	20	--	--
H8	Std.	80	47	--	--
	N	83	55	--	--

*Special Pressure Spring Choices:

A = 20-40 psi C = 150-300 psi E = 10-20 psi

B = 75-200 psi D = 40-80 psi

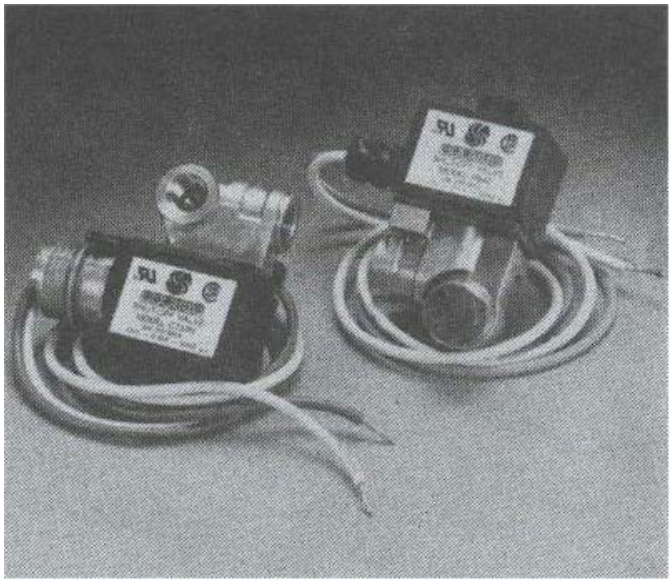
[1]Do not adjust H2 and 3450 rpm-only models (HA, HB, HH) to higher than 110 psi.

[2]Requires C spring (100-300 psi range).

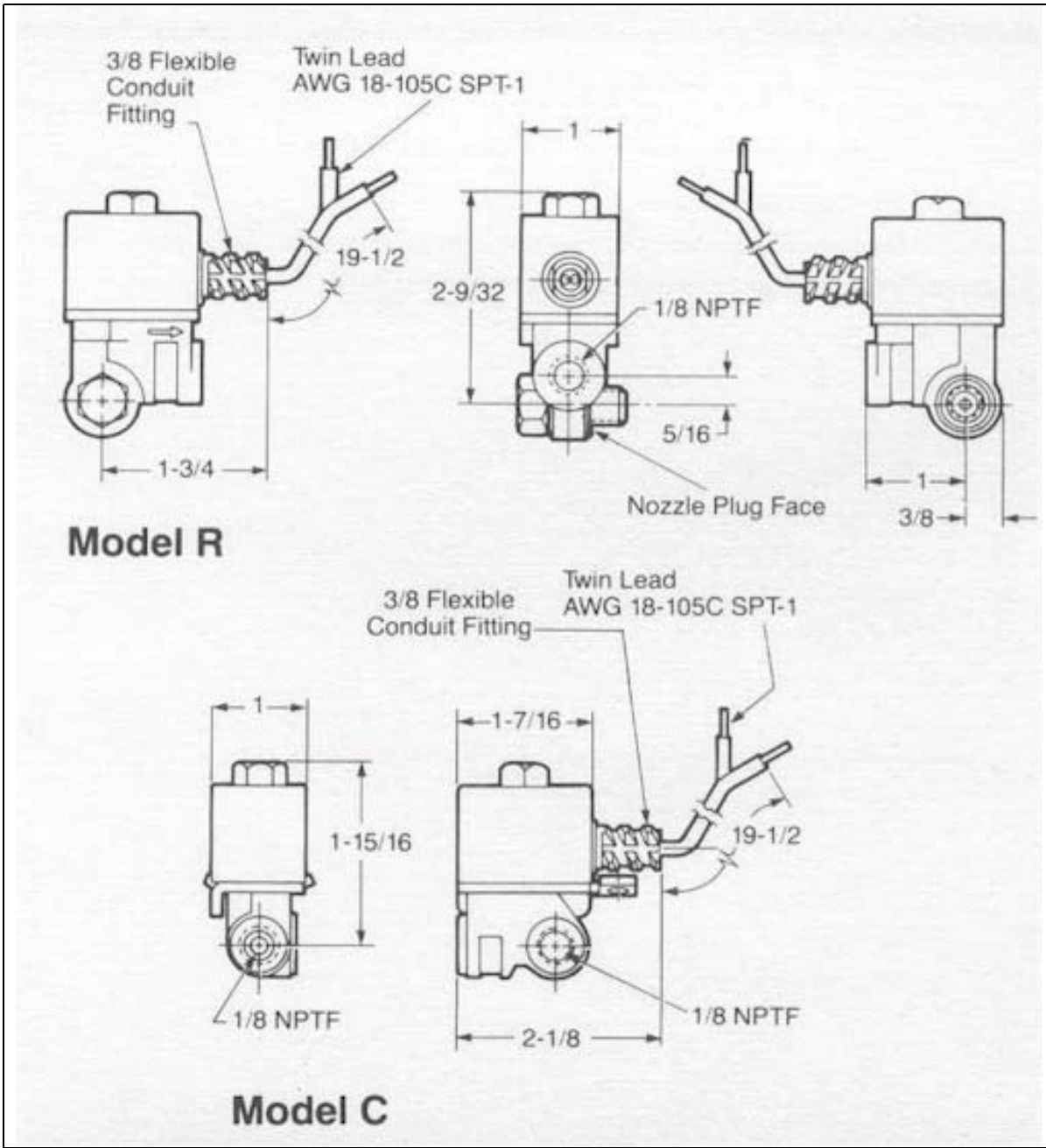
[3]Requires C spring and hardened gear.

MODEL R & C • *SHUT-OFF VALVES*

- For instantaneous, redundant cutoff of fuel supply
- Provides back-up protection
- Closes when current to solenoid coil is interrupted
- Blocks oil flow to nozzle
- Delay or non-delay opening
- Two model choices: Model R mounts to fuel unit; Model C mounts to burner or other remote locations
- Easy installation
- Use with any fuel unit rated up to 16 gph
- Suitable for no. 2, no. 1 fuel oil or kerosene
- Mount in any position

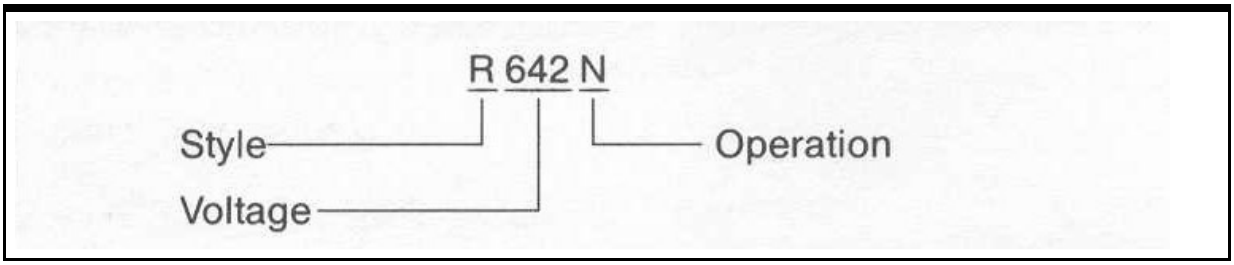


SPECIFICATIONS/ ORDERING INFORMATION



Valve Model No.		Opening Response	Voltage (50/60 Hz.)	Maximum Operating Pressure	Color Code	
Pump Mount	Burner Mount				Coil	Lead Wires
R642N	C642N	Non-Delay	115	300 psi	Black	Orange/White
R641D	C641D	Delay	115	150 psi	Grey	Orange/White
R753N	C753N	Non-Delay	220	300 psi	Black	Red/White
R261N	C261N	Non-Delay	24	300 psi	Green	Blue/Brown/ Yellow & Green

Typical Model Number Nomenclature
(Model R & Model C):*



*The model number appears on the valve label.

FOR A-7000 SINGLE-STAGE AND B-8000 TWO-STAGE FUEL UNITS
MODELS A1 & B1 FOR 1725 RPM, BLACK LABEL
MODELS A2 & B2 FOR 3450 RPM, WHITE LABEL

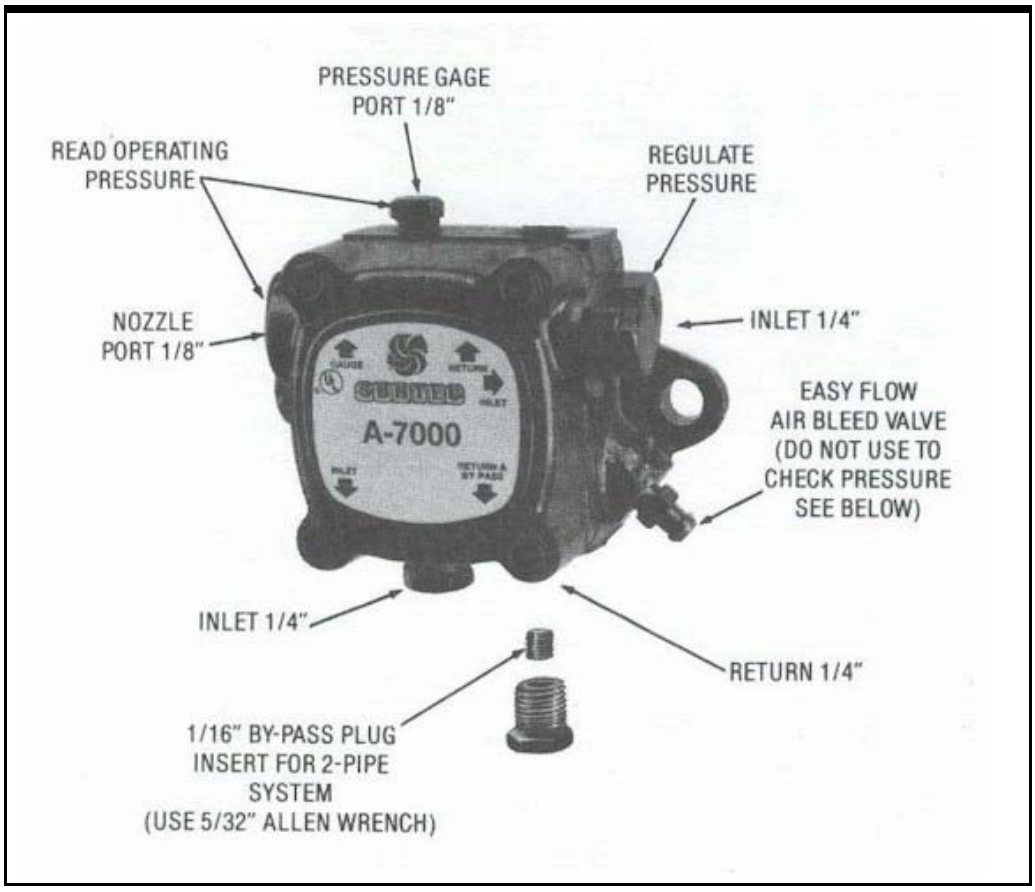


FIGURE 1

GENERAL INFORMATION ● *ALL SYSTEMS*

IMPORTANT INFORMATION Long or oversized inlet lines may require the pump to operate dry during initial bleeding period. In such cases, the priming may be assisted by injecting fuel oil into the pump gearset. Under lift conditions, oil lines and fittings must be air tight. To assure this, "pipe dope" may be applied to both the used and unused inlet and both return fittings. DO NOT USE TEFLON TAPE!! DO NOT USE COMPRESSION FITTINGS!!

MOUNTING POSITION Model "A" Single-Stage Fuel Unit may be mounted in any position. Model "B" Two-Stage Fuel Unit may be mounted in any position except upside down (1/8" ports pointed down).

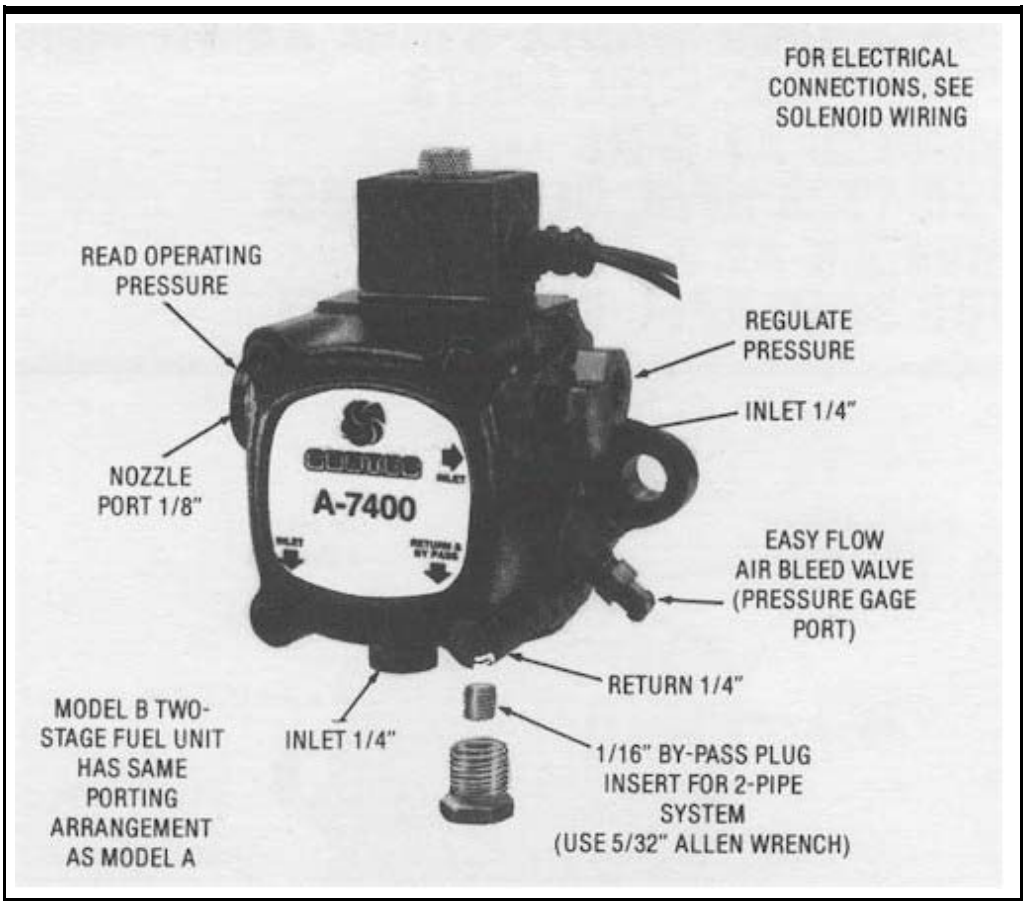


FIGURE 2

VACUUM CHECK A vacuum gage may be installed in either of the 1/4" inlet ports or in the 1/8" return port (on single-pipe installations), whichever is most convenient. The Model "A" pump should be used where the vacuum does not exceed 6" hg. single-pipe and 12" hg. two-pipe. The Model "B" should be used where vacuum does not exceed 17" hg. Remember, running vacuum is the total of all pressure drops (ΔP) in the system from tank to inlet of pump.

PRESSURE CHECK If a pressure check is made, use GAGE PORT OR NOZZLE PORT. DO NOT USE EASY FLOW BLEED VALVE PORT FOR THE 7000 SERIES. The easy flow bleed valve port contains pressure higher than operating pressure. Setting pump pressure with gage in the easy flow bleed valve port results in WRONG operating pressure. The 7400 is an exception (see Figure 2).

CUTOFF PRESSURE Average cutoff pressure for A and B fuel units is 80 psig. To check cutoff pressure, install pressure gage in nozzle port. Run burner for short period of time. Shut burner off. Gage shows cutoff pressure.

CAUTION

Pressurized or gravity feed installations must not exceed 10 P.S.I. on inlet line or return line at the pump. A pressure greater than 10 P.S.I. may cause damage to the shaft seal.

SOLENOID WIRING

DISCONNECT POWER SUPPLY BEFORE WIRING TO PREVENT ELECTICAL SHOCK OR EQUIPMENT DAMAGE. Lead wires on these devices are long enough to reach the juction box on most burner installations. Wire solenoid in parallel with burner motor (see Figure 3). All electical work should be done according to local and national codes. (Solenoid 115V, 0.1A, 60 Hz.)

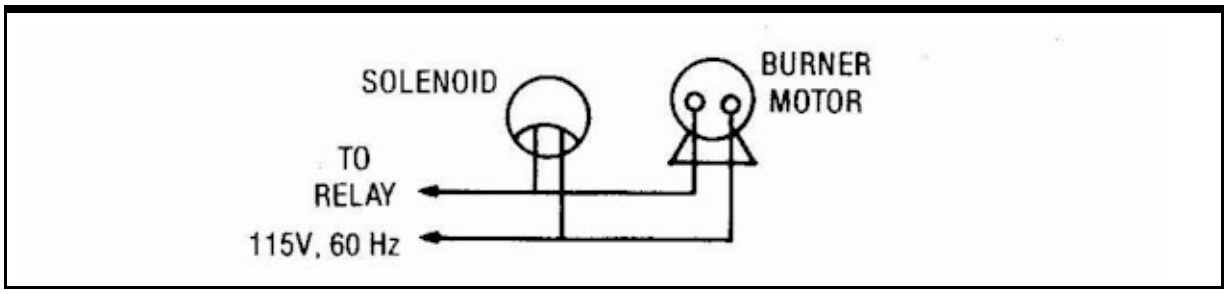


FIGURE 3

ONE-PIPE SYSTEM

DO NOT INSTALL BY-PASS PLUG! Connect inlet line to pump inlet. Start burner. Arrange primary burner control for continuous operation during purging. Open easy flow bleed valve 1 turn CCW. Bleed unit until all air bubbles disappear-HURRIED BLEEDING WILL IMPAIR EFFICIENT OPERATION OF UNIT. Tighten easy flow bleed valve securely (Figure 4). For additional information, see Single-Pipe Installation Section, page III-1 of this manual.

The SUNTEC MODEL “A”-70 FUEL UNIT may be installed ONE-PIPE with gravity feed or lift.

The maximum allowable lift is 8 feet (see Figure 4).

IMPORTANT: One-pipe installations must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely. **Bleed for 15 seconds after last air is seen from easy flow to be certain lines are air free.**

L = Line Length in Feet H = Head in Feet Q = Firing Rate in GPH

3/8” Line $L = \frac{6-.75H}{.0086Q}$ 1/2” Line $L = \frac{6-.75H}{.00218Q}$

If tank is above pump, change - to +. Fittings, valves, and filters will reduce total length allowed.

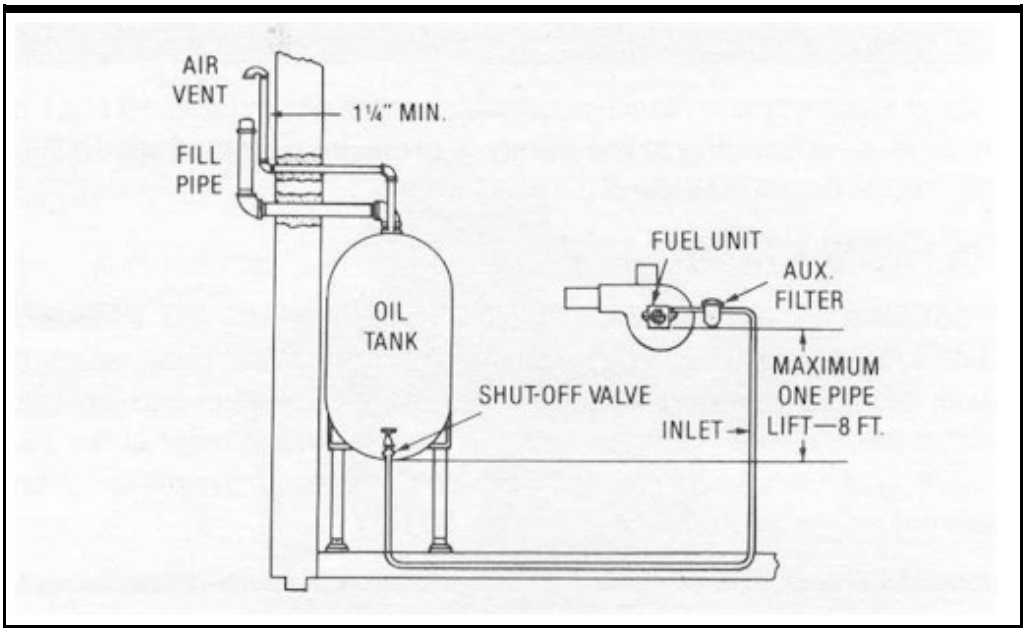


FIGURE 4

TWO-PIPE SYSTEM

REMOVE 1/16" BY-PASS PLUG FROM PLASTIC BAG ATTACHED TO UNIT. Remove 1/4" plug from return port. Insert by-pass plug (see Figure 1 or 2). Attach return and inlet lines. Start burner-air bleeding is automatic. Opening easy flow air bleed valve will allow a faster bleed, if desired. Return line must terminate 3-4" above supply line inlet (see Figure 5). Failure to do this may introduce air into the system and could result in loss of prime. For additional information, see Two pipe Installation Section, page III-3 of this manual.

Always terminate return line as shown in Figure 5. Line lengths include both vertical and horizontal lengths.

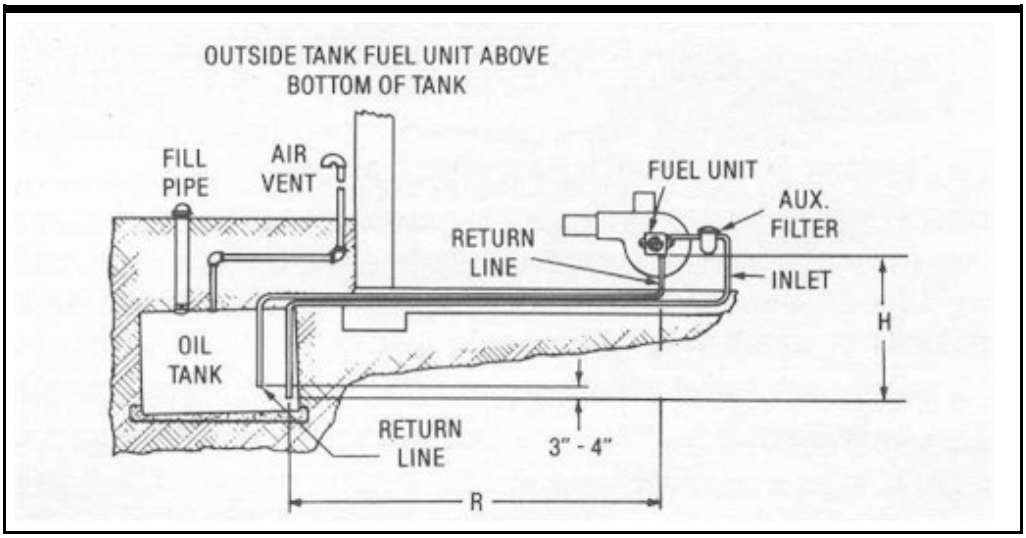


FIGURE 5

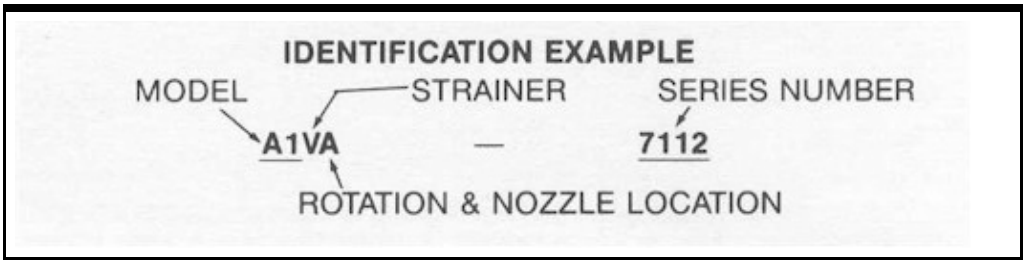
A. SINGLE-STAGE • *TWO-PIPE MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 5	1725 RPM		3450 RPM			
	3/8" OD Tubing	1/2" OD Tubing	3/8" OD Tubing		1/2" OD Tubing	
	3 GPH	3 GPH	3 GPH	7 GPH	3 GPH	7 GPH
0'	86'	100'	84'	71'	100'	100'
1'	80'	100'	78'	66'	100'	100'
2'	75'	100'	73'	62'	100'	100'
3'	70'	100'	68'	57'	100'	100'
4'	64'	100'	63'	53'	100'	100'
5'	59'	100'	57'	48'	100'	100'
6'	54'	100'	52'	44'	100'	100'
7'	49'	100'	47'	39'	100'	100'
8'	43'	100'	42'	35'	100'	100'
9'	37'	100'	36'	31'	100'	100'
10'	32'	100'	31'	27'	100'	100'
11'	26'	100'	26'	22'	100'	87'
12'	21'	85'	21'	18'	83'	70'
13'	-	63'	-	-	62'	52'
14'	-	42'	-	-	41'	35'

B. TWO-STAGE ● *TWO-PIPE MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 5	1725 RPM				3450 RPM			
	3/8" OD Tubing		1/2" OD Tubing		3/8" OD Tubing		1/2" OD Tubing	
	3 GPH	7 GPH	3 GPH	7 GPH	3 GPH	7 GPH	3 GPH	7 GPH
0'	100'	91'	100'	100'	93'	80'	100'	100'
2'	100'	83'	100'	100'	85'	73'	100'	100'
4'	89'	75'	100'	100'	77'	66'	100'	100'
6'	80'	67'	100'	100'	69'	59'	100'	100'
8'	70'	59'	100'	100'	60'	52'	100'	100'
10'	61'	51'	100'	100'	52'	45'	100'	100'
12'	51'	43'	100'	100'	44'	38'	100'	100'
14'	41'	35'	100'	100'	36'	31'	100'	100'
16'	32'	27'	100'	100'	27'	24'	100'	93'
18'	22'	-	88'	74'	-	-	76'	65'

PUMP USAGE IDENTIFICATION



A		
Model	**Max. Nozzle Capacity (GPH) At 100 PSI**	**RPM**
A1V-7100	3	1725
A2V-7100	3	3450
A2V-7400	3	3450
A1Y-7900	7	1725
A2Y-7900	7	3450

B		
Model	**Max. Nozzle Capacity (GPH) At 100 PSI**	**RPM**
B1V-8200	3	1725
B2V-8200	3	3450
B1Y-8900	7	1725
B2Y-8900	7	3450

Strainer Type	**UL Strainer Rating (GPH)***
	# 2 Fuel Oil
V	3
Y	7
T	16
G	23

Designator	**Rotation/Nozzle Location**
A	RH/RH
B	RH/LH
C	LH/LH
D	LH/RH

*Maximum firing rate not to exceed maximum nozzle capacity or strainer rating, whichever is less. A greater firing rate requires a suitable external strainer.

ALL INSTALLATIONS SHOULD BE MADE IN ACCORDANCE WITH LOCAL AND NATIONAL CODES.

MODEL A SINGLE-STAGE, TWO-STEP
MODEL B TWO-STAGE, TWO-STEP FUEL UNITS AND
MODEL B TWO-STAGE, HIGH-PRESSURE FUELS UNITS

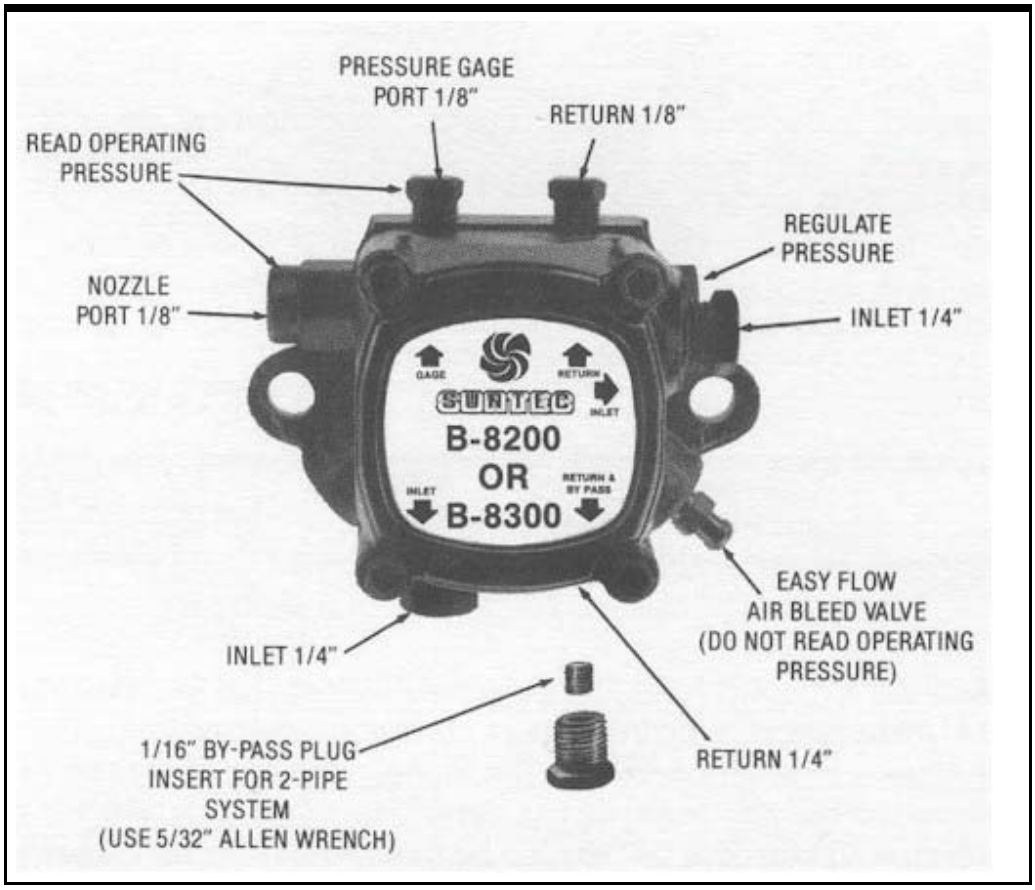


FIGURE 1

GENERAL INFORMATION ● ALL SYSTEMS

IMPORTANT INFORMATION Long or oversized inlet lines may require the pump to operate dry during initial bleeding period. In such cases, the priming may be assisted by injecting fuel oil into the pump gearset. Under lift conditions, oil lines and fittings must be air tight. To assure this, "pipe dope" may be applied to both the used and unused inlet and both return fittings. DO NOT USE TEFLON TAPE!! DO NOT USE COMPRESSION FITTINGS!!

MOUNTING POSITION Model "A" Single-Stage Fuel Unit may be mounted in any position. Model "B" Two-Stage Fuel Unit may be mounted in any position except upside down (1/8" ports pointed down).

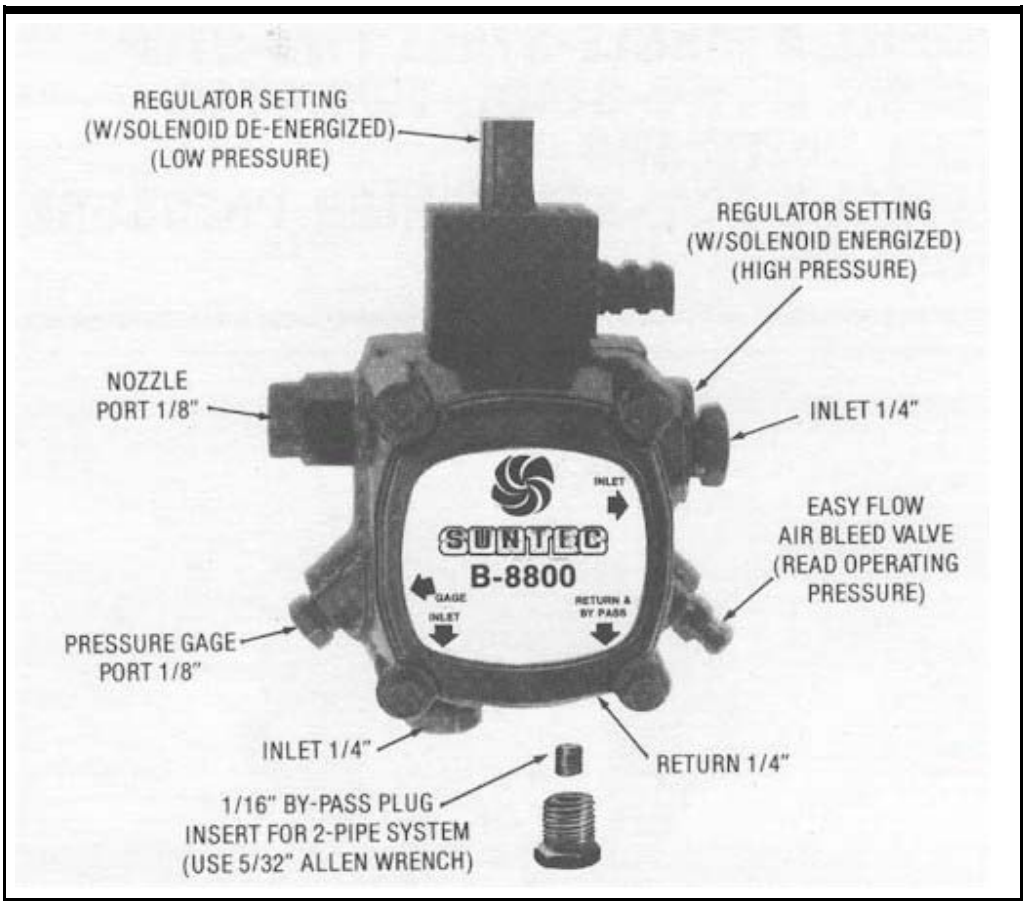


FIGURE 2

VACUUM CHECK A vacuum gage may be installed in either of the 1/4" inlet ports or in the 1/8" return port (on single-pipe installations), whichever is most convenient. The Model "A" pump should be used where the vacuum does not exceed 6" hg. single-pipe and 12" hg. two-pipe. The Model "B" should be used where vacuum does not exceed 17" hg. Running vacuum is the total of all pressure drops (ΔP) from the tank to the inlet of the pump.

CAUTION

Pressurized or gravity feed installations must not exceed 10 P.S.I. on inlet line or return line at the pump. A pressure greater than 10 P.S.I. may cause damage to the shaft seal.

TWO-STEP-PUMPS ● *FIGURE 2*

MODEL SHOWN IS RIGHT-HAND ROTATION; ALL PORTS ARE REVERSED FOR LEFT-HAND ROTATION.

SOLENOID WIRING Refer to burner manufacturer's manual for instructions.

REGULATOR SETTING Install pressure gage in gage port (remove after adjustment); proper nozzle in nozzle line.

- Low Fire -- With solenoid de-energized, adjust low-fire regulator to desired pressure. (Range 100 to 200 PSI)
- High Fire -- With solenoid energized, adjust high-fire regulator to desired pressure. (Range 200 to 300 PSI)

NOTE: EXTERNAL CUTOFF VALVE IS REQUIRED.

ONE-PIPE SYSTEM ● *FIGURE 3*

DO NOT INSTALL BY-PASS PLUG! Connect inlet line to pump inlet. Start burner. Arrange primary burner control for continuous operation during purging. Open easy flow bleed valve 1 turn CCW. Bleed unit until all air bubbles disappear -- HURRIED BLEEDING WILL IMPAIR EFFICIENT OPERATION OF UNIT. Tighten easy flow bleed valve securely. For additional information, see Single-Pipe installation Section, page III-1 of this manual.

ONE-PIPE SYSTEM ● *MODEL A*

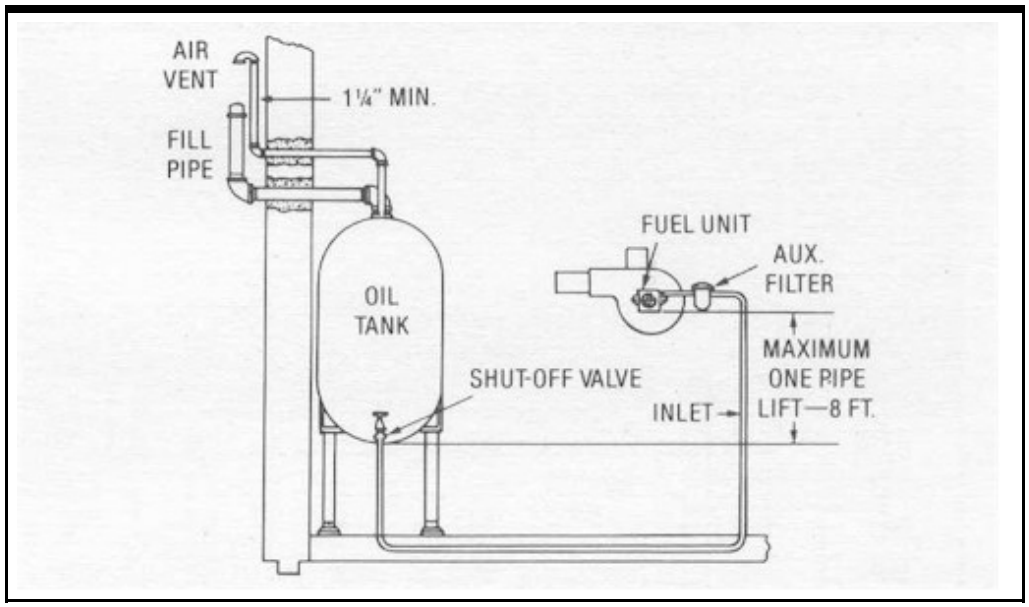


FIGURE 3

The SUNTEC MODEL "A"-70 FUEL UNIT may be installed ONE-PIPE with gravity feed or lift.

The maximum allowable lift is 8 ft. -- see Figure 3.

IMPORTANT: One-pipe installations must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely. **Bleed for 15 seconds after last air is seen from easy-flow to be certain lines are air free.**

L = Line Length in Feet H = Head in Feet Q = Firing Rate in GPH

$$\text{3/8" Line } L = \frac{6 - .75H}{.0086\ Q} \qquad \text{1/2" Line } L = \frac{6 - .75H}{.00218\ Q}$$

If tank is above pump, change - to +. Fittings, valves, and filters will reduce total length allowed.

TWO-PIPE SYSTEM ● *FIGURE 4*

REMOVE 1/16" BY-PASS PLUG FROM PLASTIC BAG ATTACHED TO UNIT. Remove 1/4" plug from return port. Insert by-pass plug (see Figure 1 or 2), tighten plug. Attach return and inlet lines. Start burner - air bleeding is automatic. Opening easy flow air bleed valve will allow a faster bleed if desired. Return line must terminate 3-4" above supply line inlet (see Figure 4). Failure to do this may introduce air into the system and could result in loss of prime.

For additional information, see Two-Pipe Installation Section, page III-3 of this manual.

TWO-PIPE SYSTEM ● *MODEL A AND B*

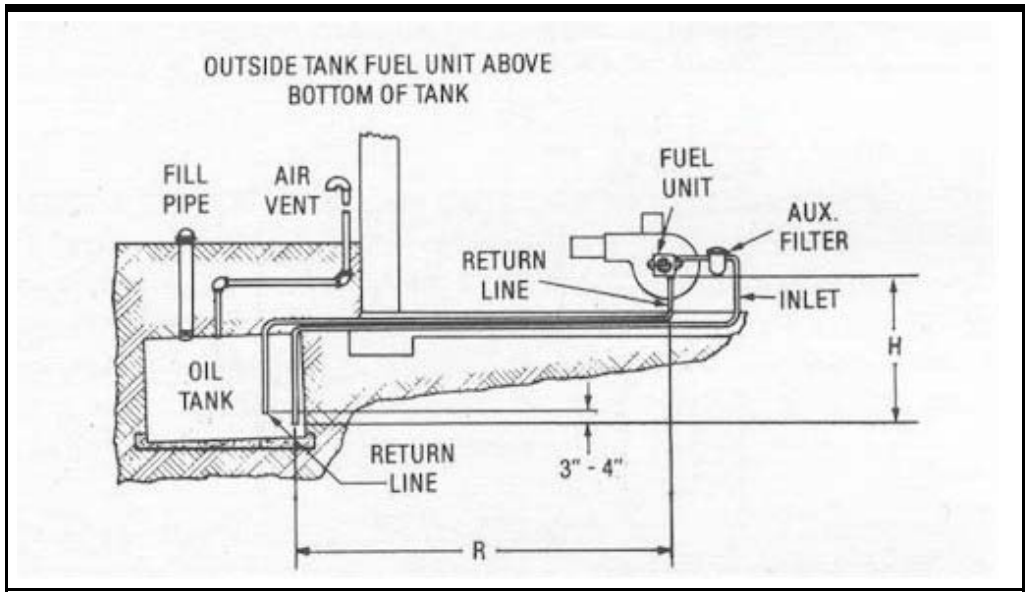


FIGURE 4

Always terminate return line as shown in Figure 4. Line lengths include both vertical and horizontal lengths.

ALL INSTALLATIONS SHOULD BE MADE IN ACCORDANCE WITH LOCAL AND NATIONAL CODES.

MODEL A SINGLE-STAGE TWO-STEP ● *TWO-PIPE MAXIMUM LINE LENGTH (H + R)*

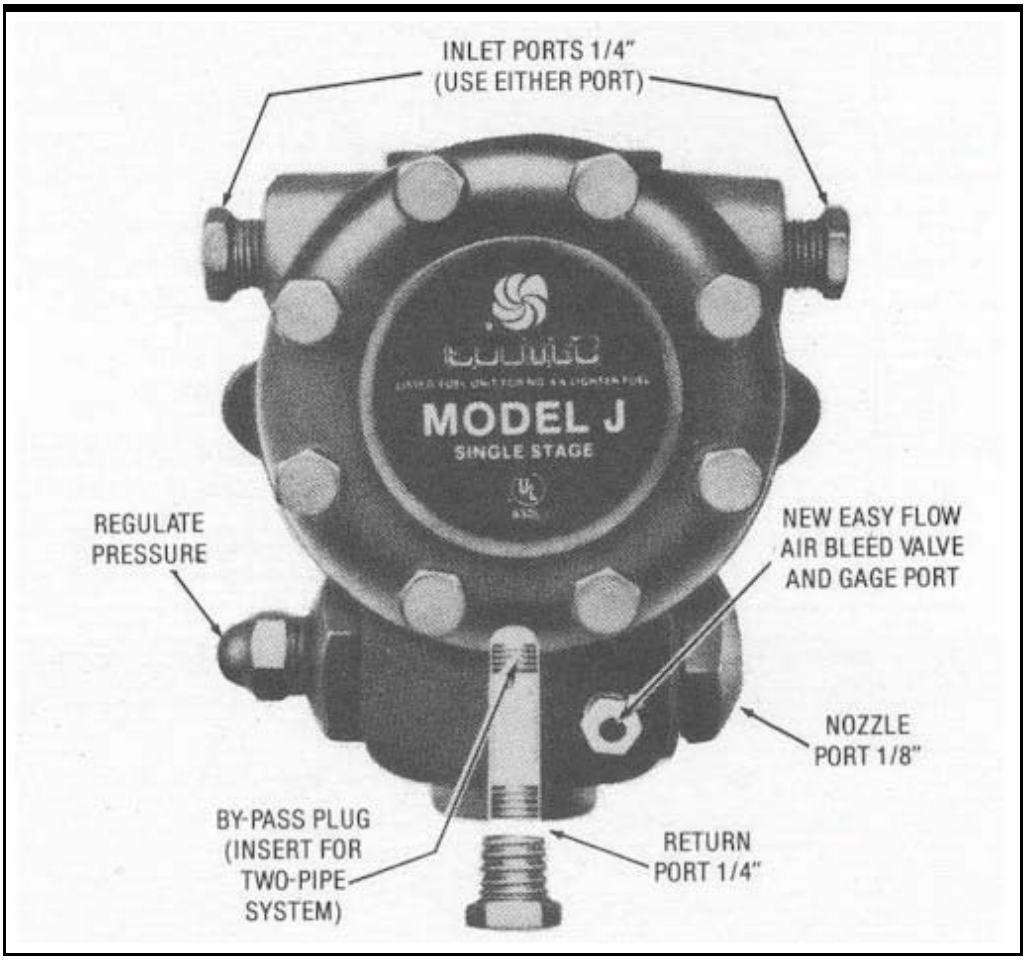
Lift "H" Figure 4	3450 RPM					
	3/8" OD Tubing		1/2" OD Tubing			5/8" OD Tubing
	10 GPH	16 GPH	10 GPH	16 GPH	23 GPH	23 GPH
0'	33'	29'	100'	100'	72'	100'
1'	31'	27'	100'	100'	66'	100'
2'	28'	25'	100'	98'	59'	100'
3'	25'	23'	100'	89'	53'	100'
4'	23'	20'	92'	80'	46'	100'
5'	21'	18'	82'	72'	40'	100'
6'	18'	16'	72'	63'	34'	100'
7'	16'	14'	62'	55'	27'	88'
8'	13'	12'	52'	46'	20'	72'
9'	11'	9'	43'	37'	14'	56'
10'	-	-	33'	29'	8'	39'

MODEL B TWO-STAGE TWO-STEP AND TWO-STAGE HIGH-PRESSURE ● *TWO-PIPE MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 4	3450 RPM					
	3/8" OD Tubing		1/2" OD Tubing			5/8" OD Tubing
	10 GPH	16 GPH	10 GPH	16 GPH	23 GPH	23 GPH
0'	70'	60'	100'	100'	100'	100'
2'	64'	55'	100'	100'	100'	100'
4'	58'	50'	100'	100'	100'	100'
6'	52'	44'	100'	100'	100'	100'
8'	45'	39'	100'	100'	100'	100'
10'	39'	34'	100'	100'	100'	100'
12'	33'	28'	100'	100'	94'	100'
14'	27'	23'	100'	91'	76'	100'
16'	21'	18'	81'	70'	59'	100'
18'	-	-	57'	49'	41'	100'

* Maximum firing rate not to exceed maximum nozzle capacity or strainer rating, whichever is less. A greater firing rate requires a suitable external strainer.

SUNTEC ROTA-ROLL® FUEL UNITS
MODEL J SINGLE-STAGE AND MODEL H TWO-STAGE



GENERAL INFORMATION ● *ALL SYSTEMS*

1. Oil lines should not be smaller than 1/2" O.D. copper tubing. See line sizing charts in this section or check line sizing on page III-7 of this manual.
2. Oil lines must be airtight. Check all connections and fittings. Do not use teflon tape. Do not use compression fittings.
3. During initial start-up or on a dry system, prime the pump with clean lubricating oil or motor oil.
4. Return line pressure must never exceed 10 PSI. Higher pressures can damage the seal or cause leaks.
5. **Mounting Position -** J pumps can be mounted in any position. H pumps can be mounted with the piston chamber (regulating valve) horizontal at either the top or bottom.

ONE-PIPE SYSTEM

Do not install by-pass plug! Connect inlet line to pump inlet. Start burner. Open easy flow bleed valve one turn CCW. Bleed unit until all air bubbles disappear. Tighten easy flow bleed valve. Figures 1 and 2 show typical one-pipe installations. J and H pumps are not recommended for lifts (H) above two feet or 2 inches mercury inlet vacuum with the exception of the J2XXF pump.

For additional information, see Single-Pipe Installation Section, page III-1 of this manual. Figures 1 and 2 are typical one-pipe systems.

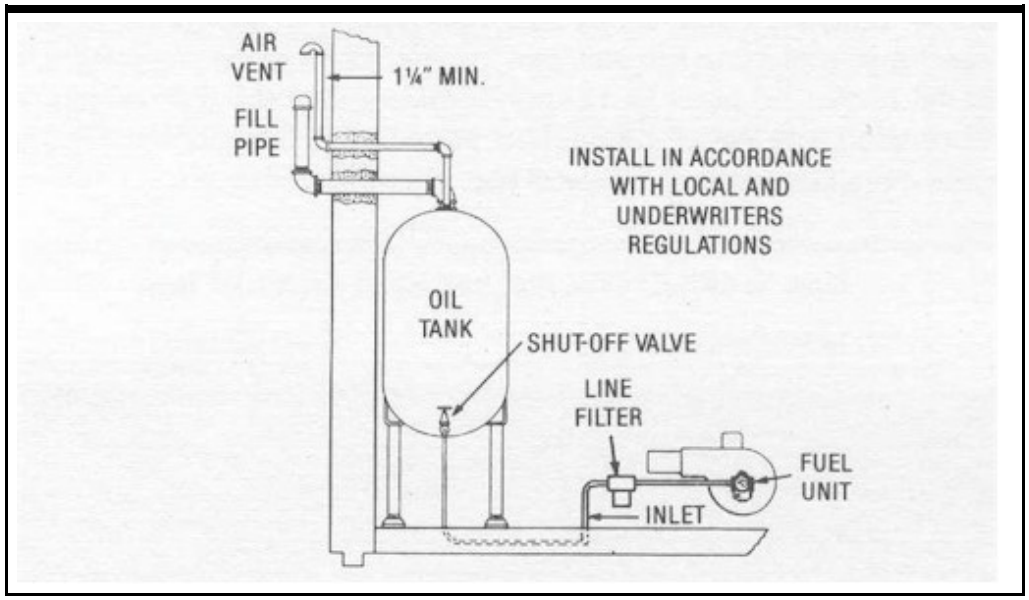


FIGURE 1

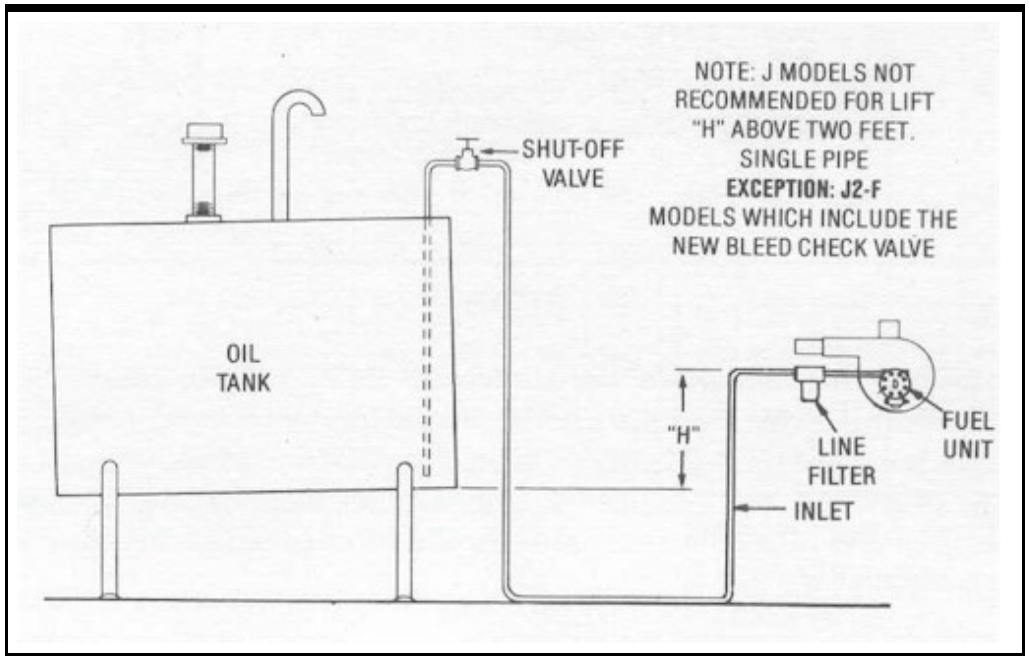


FIGURE 2

L = Line Length in Feet H = Head in Feet Q = Firing Rate in GPH

$$\text{3/8" Line } L = \frac{2 - .75H}{.0086\ Q} \qquad \text{1/2" Line } L = \frac{2 - .75H}{.00218\ Q}$$

If tank is above pump, change - to +. Fittings, valves, and filters will reduce total length allowed.

TWO-PIPE SYSTEM

Install by-pass plug inside the return port of the pump, using an allen wrench and making sure it is tight. (See illustration at the beginning of this section.) On a connected two-pipe, the fuel pump is self-priming. Model J can be used two-pipe to 12-inch mercury vacuum; Model H can be used to 17-inch mercury vaccum. For additional information, see Two-Pipe Section, page III-3 of this manual. Figures 3 and 4 are illustrations of typical two-pipe installations.

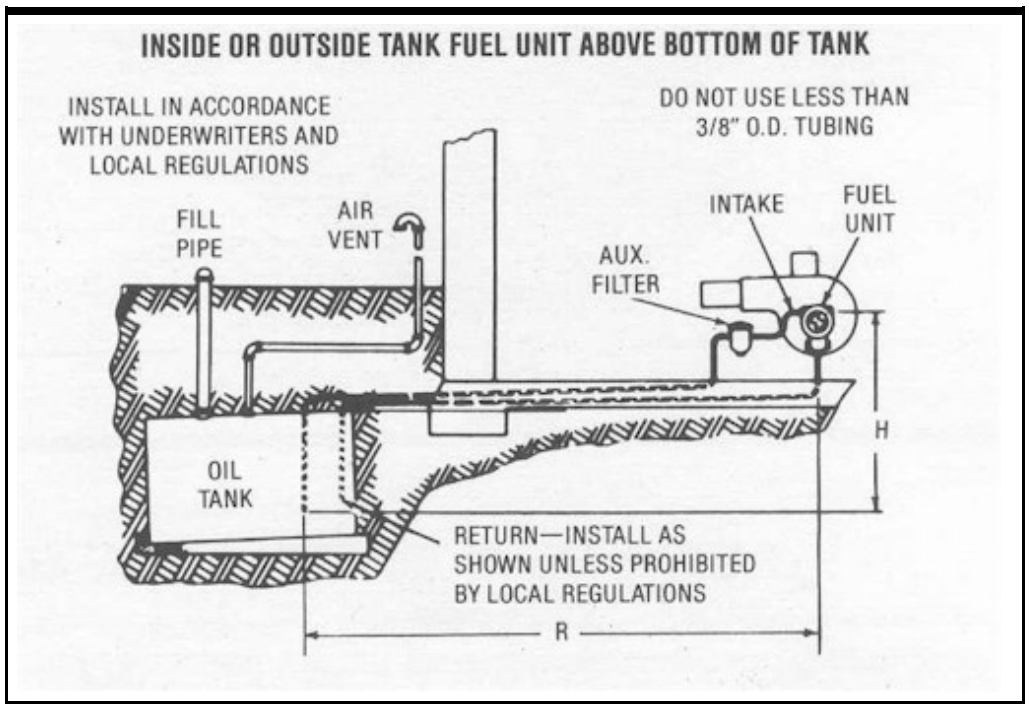


FIGURE 3

Maximum recommended horizontal run for suction or return. For conditions longer than the charts, please contact factory. Although there is a chart for 3/8" copper lines, it is recommended that you not use less less 1/2" copper tubing. On all installations, running vacuum and return line pressure should be checked before leaving any installation.

LIFT CONDITION ● *MAXIMUM LINE LENGTH (H + R)*										
Lift "H" Figure 3	**3/8" O.D. Tubing (1725 RPM)**									
	J_2	**J_3**	**J_4**	**J_5**	**J_6**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**
0'	78'	78'	63'	48'	37'	100'	90'	75'	65'	55'
2'	68'	68'	55'	42'	32'	100'	83'	70'	60'	51'
4'	58'	58'	47'	36'	28'	92'	76'	64'	55'	47'
6'	49'	49'	39'	30'	23'	84'	70'	58'	50'	42'
8'	39'	39'	32'	24'	18'	76'	63'	53'	45'	38'
10'	29'	29'	24'	18'	14'	68'	56'	47'	40'	34'
12'	19'	19'	16'	-	-	60'	49'	41'	36'	30'
14'	-	-	-	-	-	52'	43'	36'	31'	26'
16'	-	-	-	-	-	43'	36'	30'	26'	22'
18'	-	-	-	-	-	35'	29'	24'	21'	-

LIFT CONDITION ● *MAXIMUM LINE LENGTH (H + R)*												
Lift "H" Figure 3	**1/2" O.D. Tubing (1725 RPM)**											
	J_2	**J_3**	**J_4**	**J_5**	**J_6**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**	**H_7**	**H_8**
0'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	94'
2'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	87'
4'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	80'
6'	100'	100'	100'	100'	91'	100'	100'	100'	100'	100'	100'	73'
8'	100'	100'	100'	95'	73'	100'	100'	100'	100'	100'	93'	66'
10'	100'	100'	94'	71'	55'	100'	100'	100'	100'	100'	83'	59'
12'	77'	77'	62'	48'	36'	100'	100'	100'	100'	100'	73'	52'
14'	39'	39'	31'	24'	18'	100'	100'	100'	100'	100'	63'	45'
16'	-	-	-	-	-	100'	100'	100'	100'	87'	53'	38'
18'	-	-	-	-	-	100'	100'	97'	83'	70'	43'	31'

FIGURE 3

(Figure 3 continued on next page)

LIFT CONDITION ● *MAXIMUM LINE LENGTH (H + R)*								
Lift "H" Figure 3	**1/2" O.D. Tubing (3450 RPM)**							
	JJ_2	**JA_2**	**JB_2**	**J_2**	**J_3**	**J_4**	**J_5**	**J_6**
0'	100'	100'	100'	100'	100'	100'	92'	71'
2'	100'	100'	100'	100'	100'	100'	80'	62'
4'	100'	100'	100'	100'	100'	89'	69'	53'
6'	91'	91'	91'	91'	91'	75'	57'	44'
8'	73'	73'	73'	73'	73'	60'	46'	35'
10'	55'	55'	55'	55'	55'	45'	34'	27'
12'	36'	36'	36'	36'	36'	30'	23'	18'
14'	18'	18'	18'	18'	18'	-	-	-

LIFT CONDITION ● *MAXIMUM LINE LENGTH (H + R)*								
Lift "H" Figure 3	**1/2" O.D. Tubing (3450 RPM)**							
	HH_2	**HA_2**	**HB_2**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**
0'	100'	100'	100'	100'	100'	100'	98'	84'
2'	100'	100'	100'	100'	100'	100'	90'	77'
4'	100'	100'	100'	100'	100'	93'	81'	69'
6'	100'	100'	100'	100'	94'	83'	72'	62'
8'	100'	100'	100'	96'	83'	73'	64'	54'
10'	100'	97'	90'	83'	72'	63'	55'	47'
12'	89'	82'	76'	70'	60'	53'	46'	40'
14'	72'	67'	62'	57'	49'	43'	38'	32'
16'	56'	51'	48'	44'	38'	33'	29'	25'
18'	39'	36'	33'	30'	26'	23'	20'	-

FIGURE 3

(Figure 3 continued on next page)

LIFT CONDITION ● *MAXIMUM LINE LENGTH (H + R)*								
Lift "H" Figure 3	**5/8" O.D. Tubing (3450 RPM)**							
	JJ_2	**JA_2**	**JB_2**	**J_2**	**J_3**	**J_4**	**J_5**	**J_6**
0'	100'	100'	100'	100'	100'	100'	100'	100'
2'	100'	100'	100'	100'	100'	100'	100'	100'
4'	100'	100'	100'	100'	100'	100'	100'	100'
6'	100'	100'	100'	100'	100'	100'	100'	100'
8'	100'	100'	100'	100'	100'	100'	100'	98'
10'	100'	100'	100'	100'	100'	100'	96'	74'
12'	100'	100'	100'	100'	100'	83'	64'	49'
14'	51'	51'	51'	51'	51'	41'	32'	25'

LIFT CONDITION ● *MAXIMUM LINE LENGTH (H + R)*								
Lift "H" Figure 3	**5/8" O.D. Tubing (3450 RPM)**							
	HH_2	**HA_2**	**HB_2**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**
0'	100'	100'	100'	100'	100'	100'	100'	100'
2'	100'	100'	100'	100'	100'	100'	100'	100'
4'	100'	100'	100'	100'	100'	100'	100'	100'
6'	100'	100'	100'	100'	100'	100'	100'	100'
8'	100'	100'	100'	100'	100'	100'	100'	100'
10'	100'	100'	100'	100'	100'	100'	100'	100'
12'	100'	100'	100'	100'	100'	100'	100'	100'
14'	100'	100'	100'	100'	100'	100'	100'	89'
16'	100'	100'	100'	100'	100'	92'	80'	69'
18'	100'	100'	92'	85'	73'	64'	56'	48'

FIGURE 3

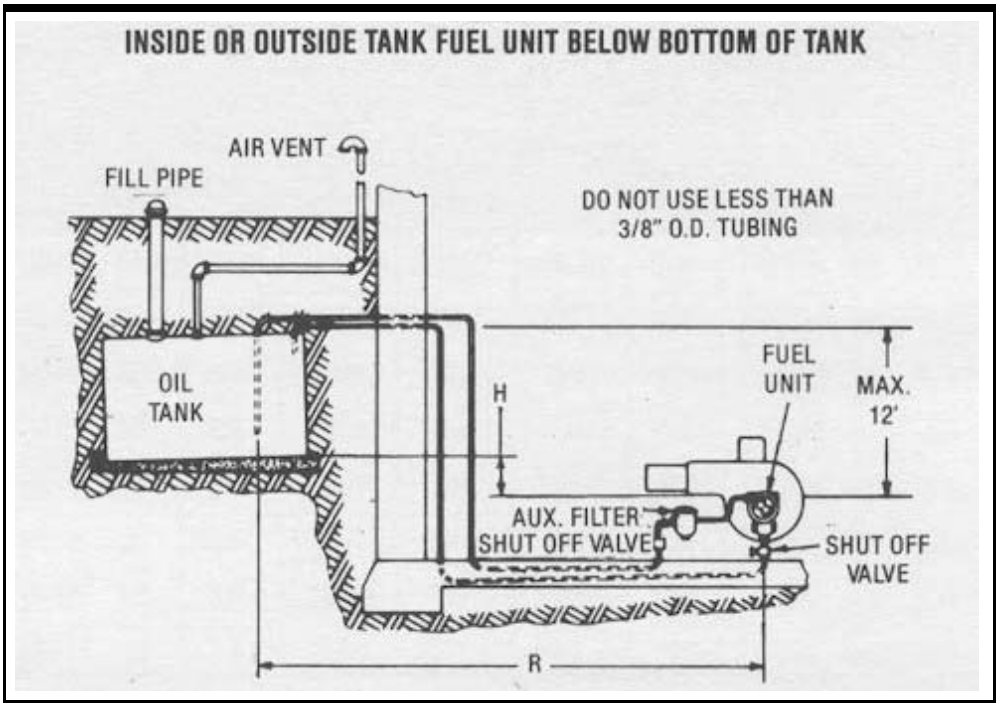


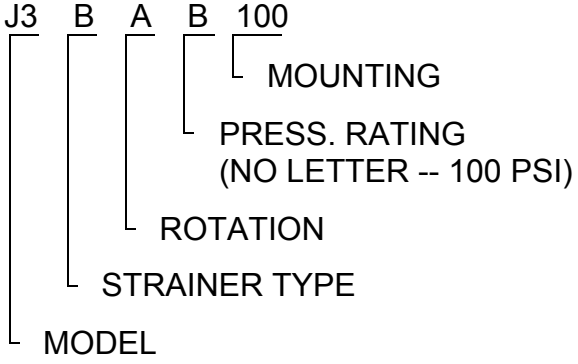
FIGURE 4

GRAVITY FEED ● *MAXIMUM LINE LENGTH (H + R)*												
Distance "H" Figure 4	**3/8" O.D. Tubing (1725 RPM)**											
	J_2	**J_3**	**J_4**	**J_5**	**J_6**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**	**H_7**	**H_8**
0'	64'	64'	53'	41'	31'	75'	75'	70'	60'	51'	30'	20'
1'	69'	69'	57'	45'	34'	78'	78'	72'	62'	52'	31'	21'
2'	74'	74'	61'	48'	36'	80'	80'	75'	64'	54'	32'	22'

Distance "H" Figure 4	**3/8" O.D. Tubing (3450 RPM)**															
	JJ_2	**JA_2**	**JB_2**	**J_2**	**J_3**	**J_4**	**J_5**	**J_6**	**HH_2**	**HA_2**	**HB_2**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**
0'	31'	31'	31'	31'	31'	25'	19'	15'	25'	25'	25'	25'	25'	23'	20'	17'
1'	33'	33'	33'	33'	33'	27'	21'	16'	26'	26'	26'	26'	26'	25'	22'	18'
2'	35'	35'	35'	35'	35'	29'	23'	17'	27'	28'	28'	28'	29'	26'	23'	19'

Distance "H" Figure 4	**1/2" O.D. Tubing (3450 RPM)**															
	JJ_2	**JA_2**	**JB_2**	**J_2**	**J_3**	**J_4**	**J_5**	**J_6**	**HH_2**	**HA_2**	**HB_2**	**H_2**	**H_3**	**H_4**	**H_5**	**H_6**
0'	100'	100'	100'	100'	100'	99'	77'	59'	100'	100'	100'	100'	100'	94'	81'	69'
1'	100'	100'	100'	100'	100'	100'	83'	63'	100'	100'	100'	100'	100'	99'	85'	72'
2'	100'	100'	100'	100'	100'	100'	89'	68'	100'	100'	100'	100'	100'	100'	89'	76'

PUMP USAGE IDENTIFICATION • EXAMPLE



Strainer Type	UL Strainer Rating (GPH)*
	#2 Fuel Oil
B	7
P	Unlimited

J PUMP

Model	Max. Nozzle Capacity (GPH) at Rated Pressure		Rated Pressure (PSI)
	1725 RPM	3450 RPM	
JA2B	0	7	100
JB2B	0	10	100
JJ2B	0	3	100
J2B	3	16	100
J2BF	3	16	100
J3B	7	20	100
J3B-B	0	14	200
J3P-B	0	14	200
J4P	10	30	100
J5B	16	40	100
J5P	16	40	100
J6B-B	15	50	200
J6B	20	55	100
J6B-C	7	40	300
J6K	20	55	100

H PUMP

Model	Max. Nozzle Capactiy (GPH) at Rated Pressure		Rated Pressure (PSI)
	1725 RPM	3450 RPM	
HA2B	0	7	100
HA2P	0	7	100
HH2B	0	3	100
H2B	3	16	100
H2P	3	16	100
H3B-B	0	14	200
H3B	7	20	100
H3B-C	0	7	300
H3P	7	20	100
H3P-B	0	14	200
H3P N-C	0	14	300
H4P-C	0	16	300
H4P	10	30	100
H4P N-C	15	20	300
H5P	16	40	100
H6B-C	7	40	300
H6P	20	55	100
H6P-C	7	40	300
H6P N-C	10	45	300
H7P-B	30	80	200
H7P	40	N/A	100
H8P	80	N/A	100
H8P N-C	55	N/A	300

* Maximum firing rate not to exceed maximum nozzle capacity or strainer rating, whichever is less. A greater firing rate requires a suitable external strainer.

WASTE OIL PUMPS

Waste oil pumps are designed to supply oil up to 1500 centistokes to remote tanks or heaters.

Line sizing listed below is calculated for multi-weight oils such as 10W-30W maintained at 32°F minimum, and straight-weight oils such as 40W, 50W, 90W and heavier gear lubes maintained at 50 °F minimum.

Pump Model No.	RPM	Delivery Pressure	Flow GPH	Maximum Operating Vacuum	Horsepower	
					< 1000 CST	> 1000 CST
J3NBN-A132B	1725	20-40 psi	18 Max.	20 In. Hg.	1/6 HP	1/4 HP
A2RA-7736	1725	30 psi**	2.5 GPH	*	1/8 HP	1/8 HP
	3450	0-100 psi	2.5 GPH	*	1/7 HP	1/7 HP
A2RA-7737	1725	10-20 psi	2.5 GPH	*	1/8 HP	1/8 HP
	3450	10-20 psi	2.5 GPH	*	1/7 HP	1/7 HP
A1RA-7738	1725	100-150 psi	2.5 GPH	*	1/8 HP	1/8 HP

* 20 In. Hg. for fuels more viscous than #2 fuel oil; 10 In. Hg. for #2 fuel oil and lighter
** Use alternate nozzle port

INLET OR SUPPLY LINES

Pump Model Number	Inlet Line Size I.D.	Inlet Line (L) Maximum
J3NBN-A132B	3/4 in.	20 ft.
J3NBN-A132B	1 in.	60 ft.
A2RA-7736 (7737, 7738)	1/2 in.	20 ft.
A2RA-7736 (7737, 7738)	3/4 in.	90 ft.

Waste oil pumps are designed for one-pipe or single-line installation. Do not install the by-pass plug. Do not use teflon tape. Use J.I.C. flare or pipr fittings only. Do not exceed 10 psi (manufacturer) or 3 psi (NFPA) when supplying to inlet of pumps. It can cause seal damage.

FILTERS

Waste oil pumps have an internal secondary 30 x 30 mesh strainer. An external primary 50 x 50 mesh strainer is required. This is supplied by the burner/furnace manufacturer. For transfer systems, this must be supplied by installer/user.

TYPICAL TANK INSTALLATIONS

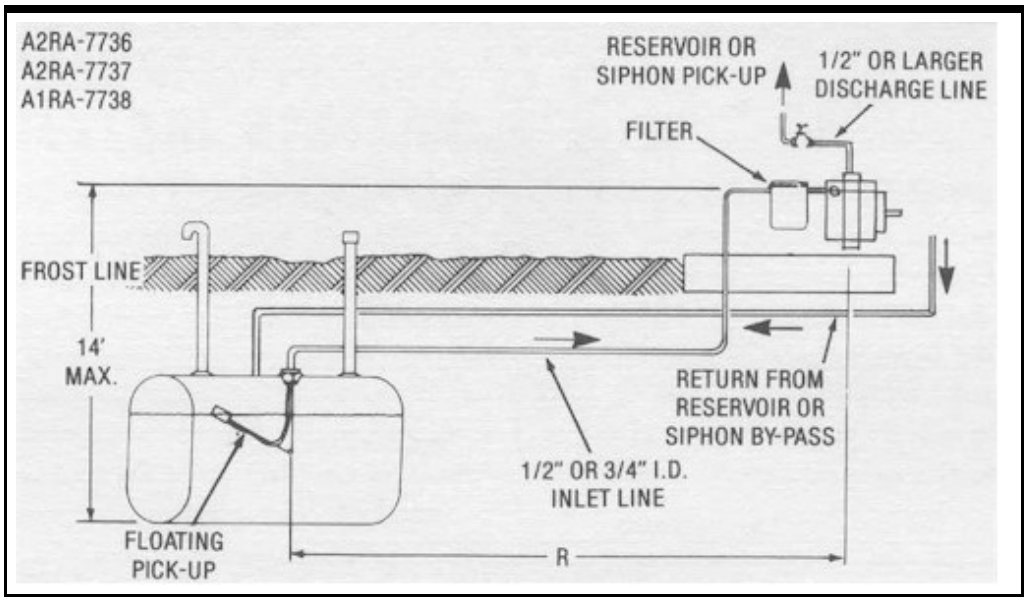


FIGURE 1 TYPICAL TANK INSTALLATION

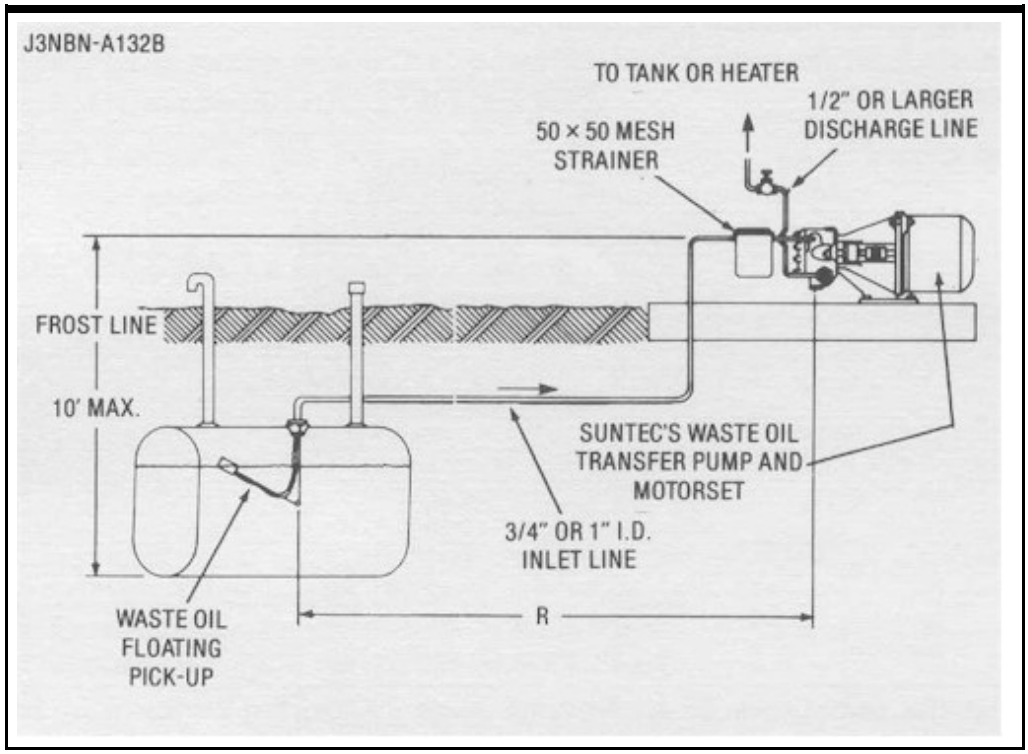


FIGURE 2 TYPICAL TANK INSTALLATION

Floating pickups are manditory for all waste oil systems. They must be a comparable line size with the rest of the inlet line.

In ambient temperatures to oil supply lines are lower than recommended, strip heaters should be installed.

PUMP CONNECTIONS

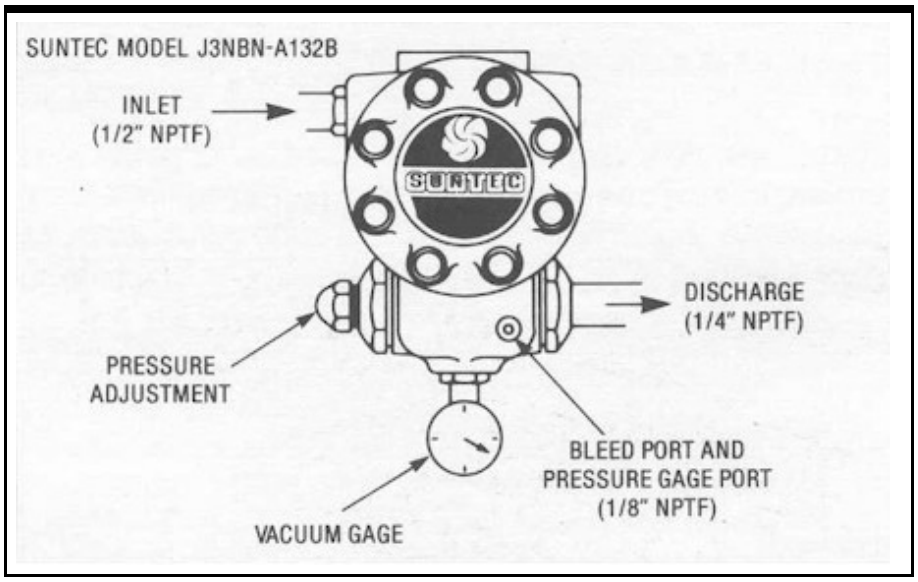


FIGURE 3

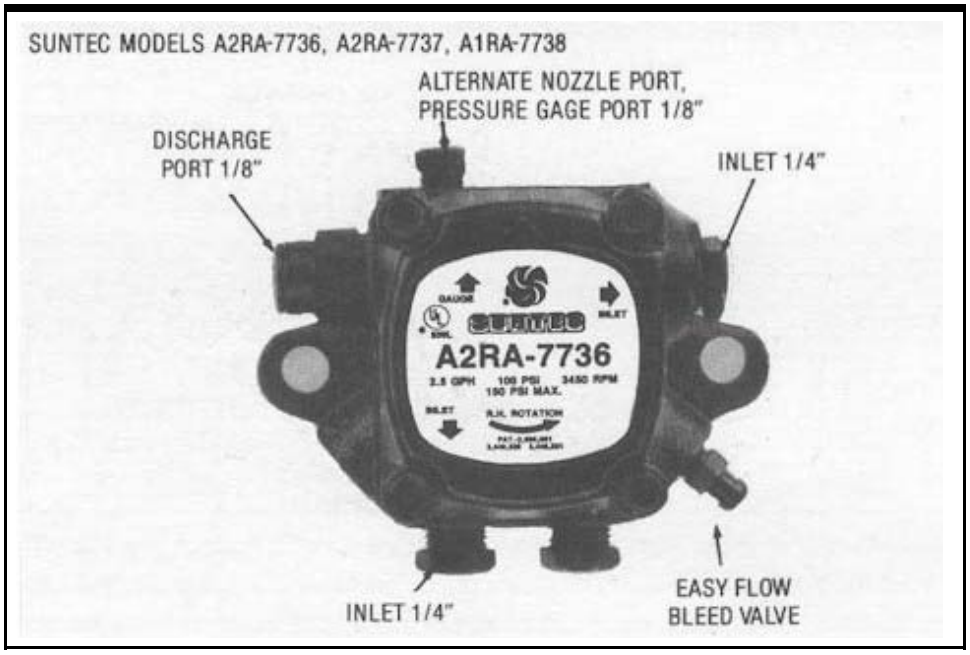


FIGURE 4

Install a vacuum gage in the inlet line close to the pump or in an unused inlet port. During operation, vacuum must not exceed the operating vacuum previously listed in this section.

PRIMING PROCEDURE

It is advisable on initial start-up to prefill the pump with clean, room temperature oil through the inlet port. Start pump and open bleed valve. Bleed pump for several minutes or until air-free oil is observed flowing from bleed port.

BOOST PUMPS
LIFT PUMPS
TRANSFER PUMPS
CENTRAL SYSTEMS

It is easier to push fuel oil to a given location than to pull it to the same location. This is easily understood when you consider the forces available. Fuel oil starts to separate or boil at vacuum levels as low as 10 in. hg. This is equivalent to a pressure differential of 4.9 psi. If you push the oil, you have pressure differentials of up to 300 psi available with no separation or boiling of the oil. Simplified, this means that having the pump lift oil, you are limited to about 15 feet of vertical lift. With a pressure of only 100 psi, the oil can be pushed or pumped up more than 200 feet.

IMPORTANT POINTS TO REMEMBER:

1. A boost pump is a fuel oil pump subject to the same restrictions as any other fuel pump.
2. Install a boost pump as close to the supply of fuel oil as economically and physically possible.
3. All burner pumps being supplied by a boost pump should be installed single-pipe, even if they are two-stage pumps.

MODELS AND SELECTIONS

BOOST PUMP				
Item		**Includes Pump Model**	**Pump Rotation (from shaft end)**	**Delivery - GPH @ RPM**
Complete Boost Pump Assembly: (Including Motor)	BB-1020M BH-1030M BH-1070M	B2VA-8241-5 H3BA-E100B H6BA-E100B	R.H. R.H. R.H.	20 30 70
Boost Pump Assembly Less Motor	BB-1020R BH-1030R BH-1070R	B2VA-8241-5 H3BA-E100B H6BA-E100B	R.H. R.H. R.H.	20 30 70
Pressure Switch		P/N 128117	40 VA & 150 psi Max.	
Adapter for 48N Motor		P/N 134462		

Boost pump assemblies are supplied with or without drive motors. The pump has an internal valve regulator (standard 10-20 psi range). The valve regulates pressure and provides a check against loss of head during shut downs. This eliminates the need for an external check valve. Standard assemblies are capable of pushing oil to 35 feet vertical height. For higher applications, a simple spring change can meet your specific requirements.

To select the correct boost pump, find the total firing rate of all the burners being supplied and select a GPH rating higher.

Example 1:

We have four burners with the following nozzle capacities or firing rates:

1 = .8 GPH
2 = .75 GPH
3 = 1.35 GPH
4 = 2.25 GPH
Total = 5.15 GPH required

Select a BB1020M which will supply 20 GPH.

Remember: The firing rates are determined by the nozzle size and pressure of the burner pump.

Example 2:

We have five burners with the following firing rates:

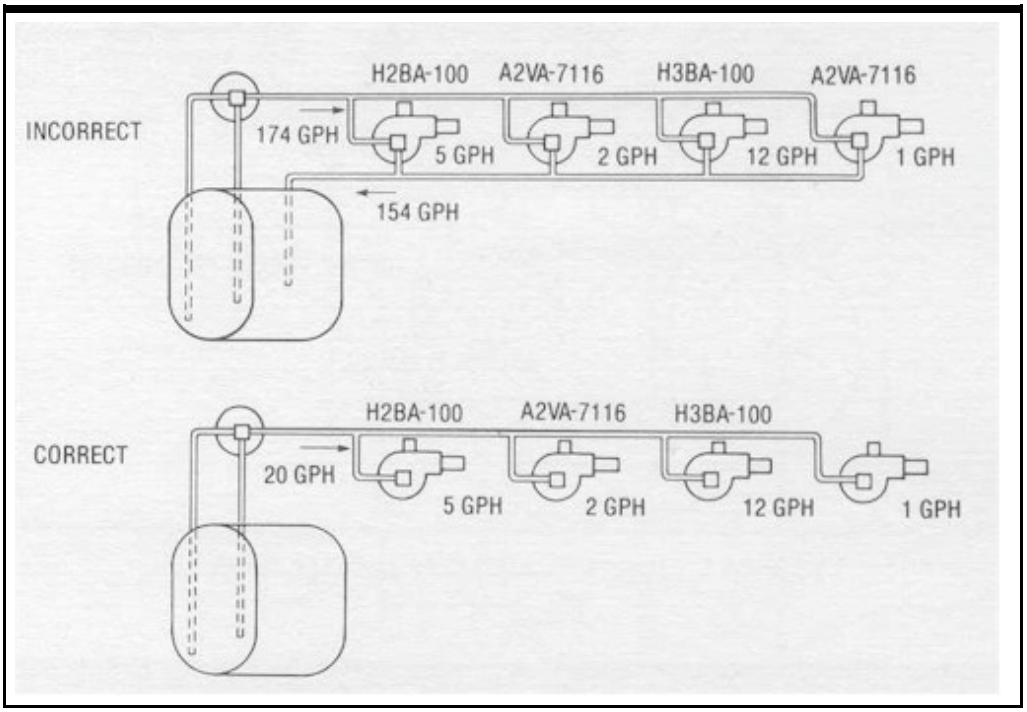
1 = 1.5 GPH Nozzle @ 150 psi = 1.8 GPH
2 = 3.0 GPH Nozzle @ 300 psi = 5.2 GPH
3 = 12.0 GPH Nozzle @ 100 psi = 12.0 GPH
4 = 5.0 GPH Nozzle @ 125 psi = 5.6 GPH
5 = 1.25 GPH Nozzle @ 100 psi = 1.25 GPH
Total = 25.85 GPH

Select a BH1030 which will supply 30 GPH.

Remember:

1. The boost pump is installed two-pipe with a by-pass plug installed and a return line.
2. The burner pumps are installed single-pipe, no by-pass plug installed and no return line. If a pump is installed two-pipe, its return line will demand its gearset capacity. If you had the smallest pump made, this would be 20 GPH. Installed single-pipe, the pump only demands its firing rate which is determined by the size of the nozzle in the burner.

Example:



INSTALLATION INSTRUCTIONS:

Note: Install in accordance with the National Board of Fire Underwriters' requirements, local codes, and ordinances where applicable.

INLET OR SUCTION SIDE OF BOOST PUMP:
Figure 1 illustrates the installation of the inlet or suction side of the boost pump and its return line. Boost pumps should be installed two-pipe for air removal and self-priming. (Two-pipe requires installation of the by-pass plug for proper operation.) In Figure 1, "H" is the vertical lift from the bottom of the tank to the center line of the boost pump. "R" is the horizontal run or distance in feet from the tank to the boost pump.

Table 1 gives limits not to exceed in the installation of the inlet line to the boost pump.

PRESSURE OR SUPPLY SIDE:
There are two common systems used: the loop system and the pressurized system. Use of an auxiliary tank is a form of the loop system. There are other piping configurations which are not recommended, but are in use, and will be discussed.

LOOP SYSTEM:
Figure 2 illustrates a single-loop system. It offers the advantage of only needing to keep the mainfold full of oil supplied at a rate greater than the total firing rate of all the burners being supplied by the system. Table 2 lists the maximum horizontal runs not to be exceeded. These are calculated for standard boost pumps with the 10-20 psi spring. For higher boosts or longer runs, call the factory and get prompt help to install your system.

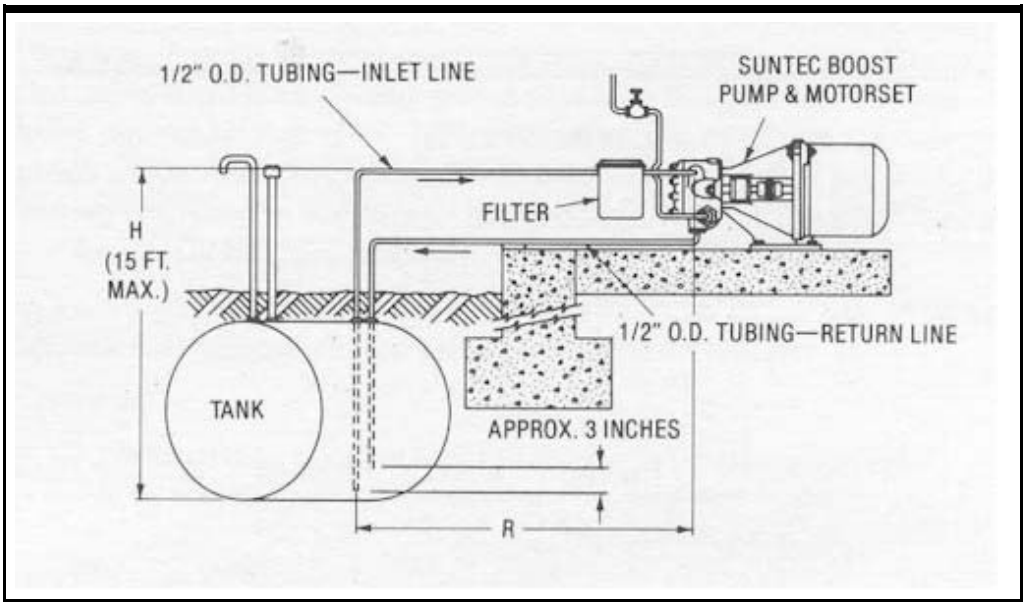


FIGURE 1 LOW PRESSURE SIDE INSTALLATION

Line Size		1/2" O.D. Tubing			5/8" O.D. Tubing			1/2" Pipe		
Lift		0-7'	10'	15'	0-7'	10'	15'	0-7'	10'	15'
Pump Model	B	100'	100'	100'						
	H3	64'	49'	24'	100'	100'	65'	100'	100'	100'
	H6	44'	34'	17'	100'	95'	48'	100'	90'	65'

TABLE 1 MAXIMUM INLET LINE LENGTH

FOR A TROUBLE-FREE LOOP SYSTEM, USE THE FOLLOWING GUIDELINES:

1. The manifold is to be above all the pumps being supplied.
2. The manifold should be level at worst case. A slight rise in the system will aid in air-purging.
3. A 2-ft. riser or kick at the end of the run will insure the manifold fills.
4. A large return line is necessary to prevent siphoning of the manifold and/or overflowing of the vent.
5. Pumps on burners supplied by the boost pump should be connected or installed single-pipe. No by-pass plug and no return lines on the burners.

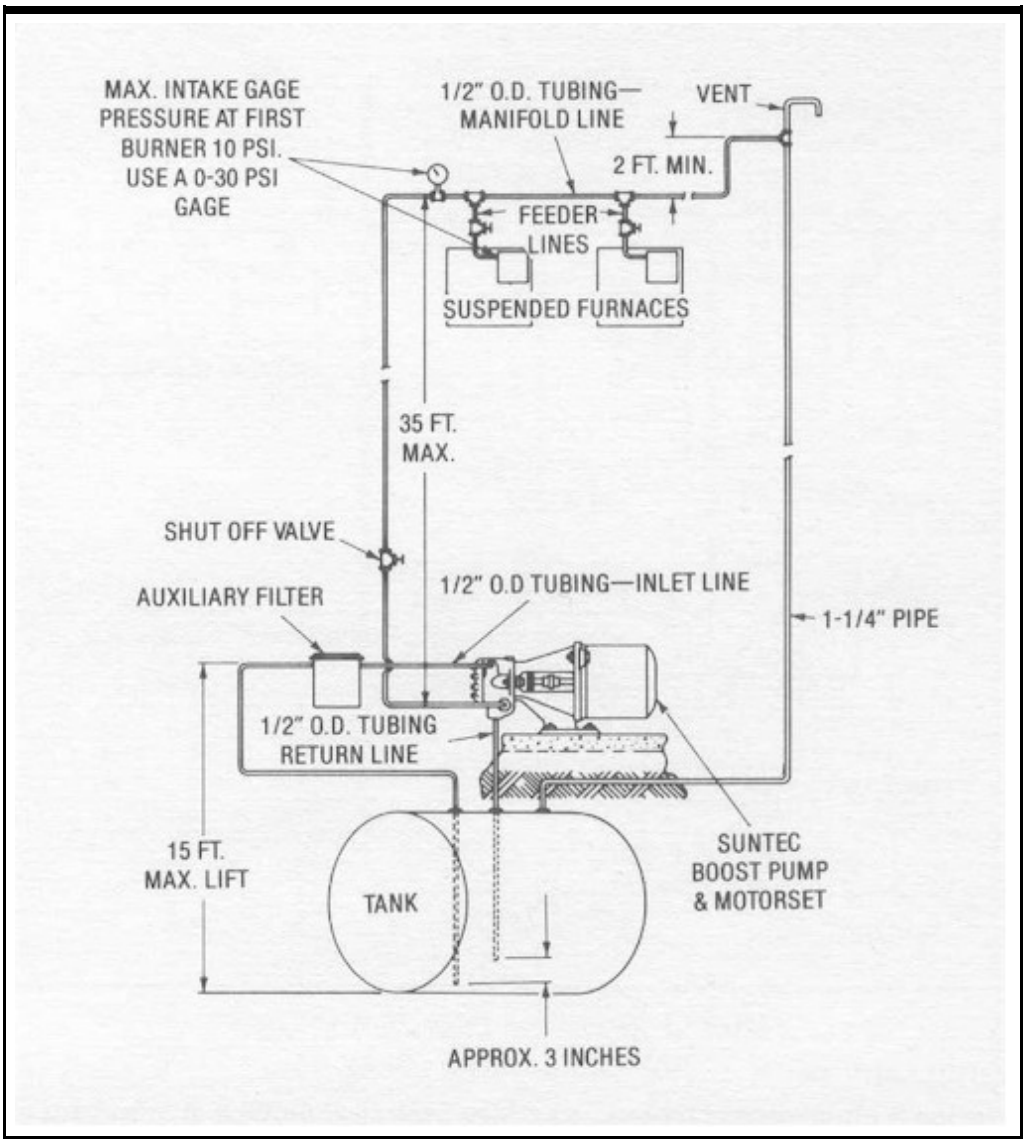


FIGURE 2 LOOP SYSTEM INSTALLATION

Boost Pump	1/2" Tube	1/2" Pipe	3/4" Pipe
B	300'	500'	2500'
H3	175'	300'	1800'
H6	50'	100'	600'

*TABLE 2 MAXIMUM HORIZONTAL LINE LENGTH**
(10-20 PSI SPRING, FACTORY PRESET AT 10 PSI)

* For longer runs, contact the factory

6. Maximum pressure at the inlet port to any of the burner pumps is 10 psi by design. However, N.F.P.A. states that maximum allowed is 3 psi. Use the lowest number per applicable codes. If the pressure is going to be higher than permissible, a pressure reducing and/or a vacuum valve must be installed to reduce inlet pressure to the pump.

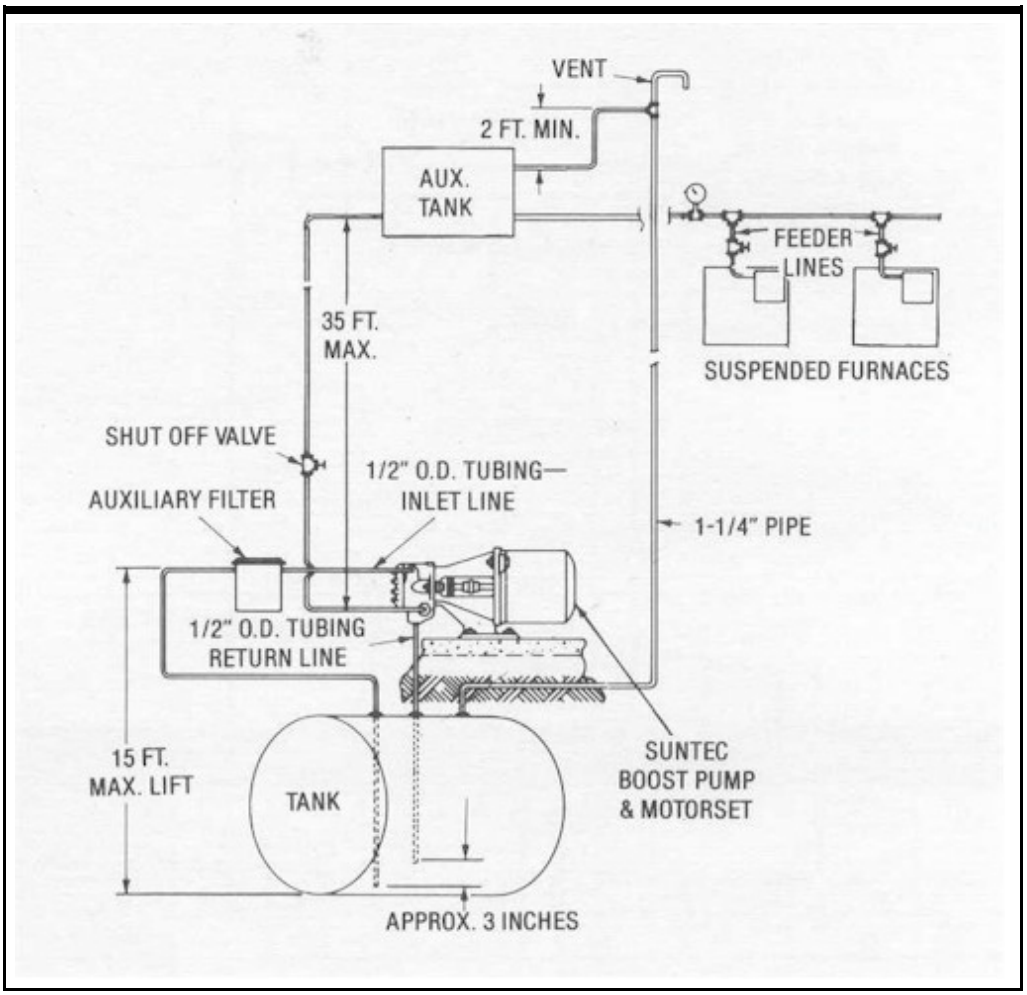


FIGURE 3 AUXILIARY TANK INSTALLATION

AUXILIARY TANK

Figure 3 illustrates a typical auxiliary tank installation. It is a form of the loop system, and subject to the same installation requirements. In addition, local ordinances governing auxiliary tanks should be complied with.

The auxiliary tank doesn't need to be more than a few gallons in capacity. It's advantages are:

1. Allows loop to be completed in close proximity to the main supply tank.
2. Eliminates line surges and race conditions.

PRESSURIZED SYSTEM

Figure 4 illustrates a pressurized system. Although it is the least common installation, it can be used where space and distance limitations preclude using the loop system.

WHEN INSTALLING THIS SYSTEM:

1. The pressure in the manifold must not exceed 10 psi when the boost pump is running and no burners are firing.

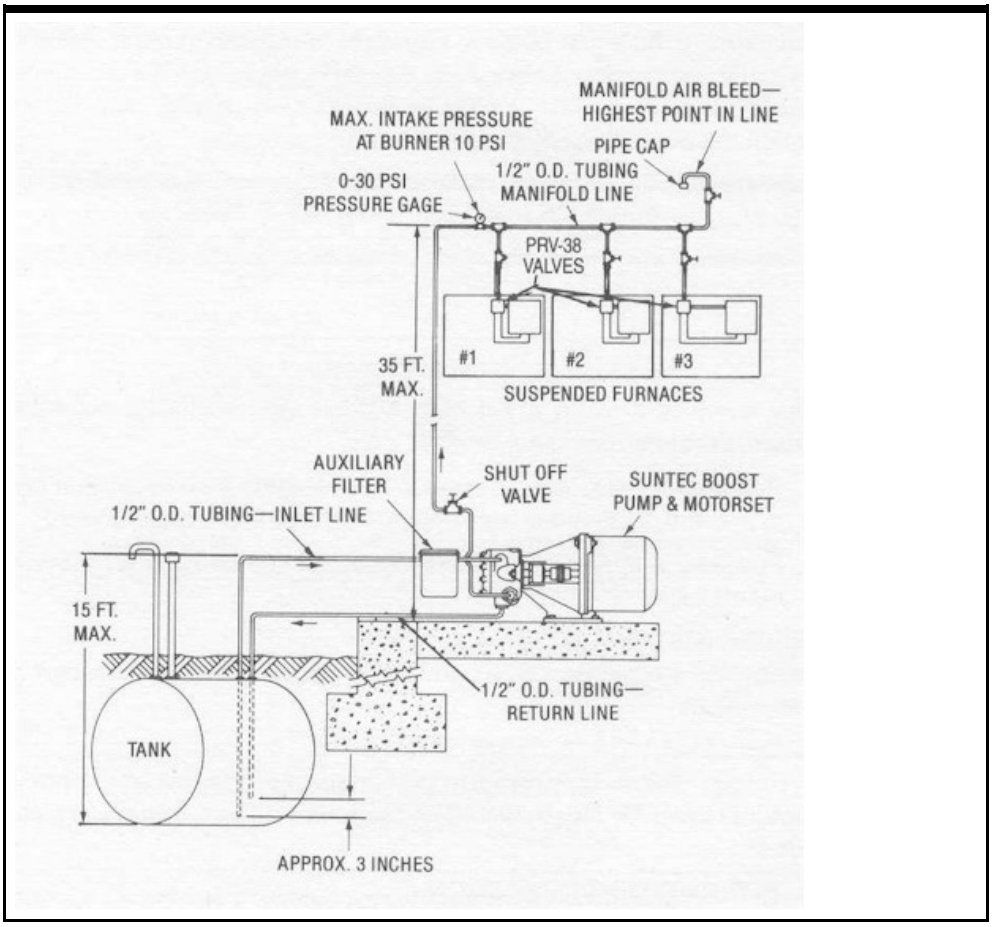
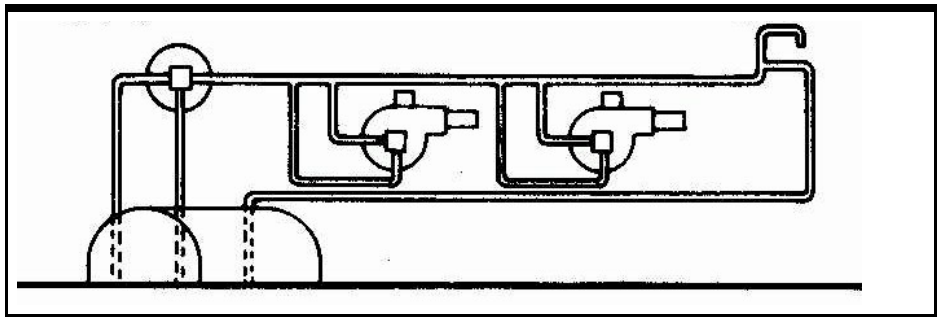


FIGURE 4 PRESSURIZED SYSTEM INSTALLATION

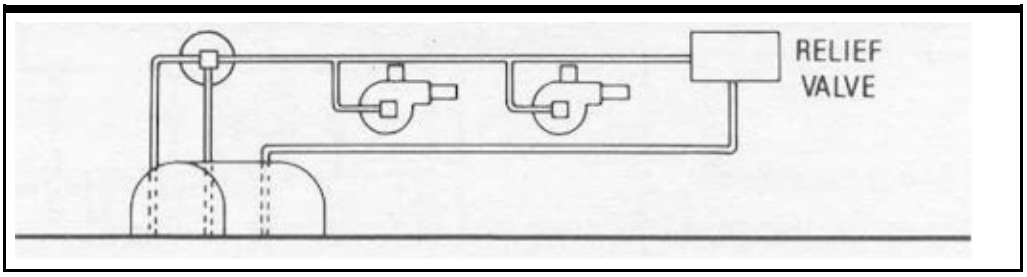
2. The pressure in the manifold must not exceed 10 psi nor less than zero when the boost pump is running and all burners are firing.
3. The burner pumps must have vacuum valves on their inlets.
4. The maximum horizontal run of the manifold line must be matched with selections from Table 2.

Other configurations which are not recommended:



PSEUDO TWO-PIPE

The intent is to gain the advantages of a two-pipe operation, while not causing the boost pump to supply burner pump gearset demand. Actually, the pump already does this internally without the external plumbing. This system includes unnecessary piping and fittings which are possible sources of problems.



PRESSURIZED LOOP

The intent is to have a full loop without vent and large manifold return. Problems are:

1. Requires boost pump pressure to be set higher than recommended to prevent oscillations between pump valve and manifold valve.
2. Possible plugging of manifold valve, putting too high pressure in manifold.

WIRING INSTRUCTIONS
Wiring the system depends upon the operation desired: constant or intermittent.

A. CONSTANT OPERATION
A voltage switch between the power source and the boost pump motor is used for simple ON/OFF operation. Figure 5 illustrates this circuit.

B. INTERMITTENT OPERATION
A pressure switch (Suntec part number 128117) is connected in the gage port of each heater's fuel unit. Figure 6 shows the switch's installation in the circuit.

Operation is simple. Pressure developed by the oil burner fuel unit closes the low-voltage switch connected to the fuel unit. This causes the switch relay to energize the boost pump, which starts and stops automatically with the oil burner. For initial start-up, the switch relay may be held in manually, or a manual ON/OFF switch may be connected across the low-voltage wire leading from the switch relay to the pressure switch. With the manual switch in the ON position, the boost pump runs continuously.

START UP

1. Start boost pump manually.
2. Set boost pump pressure in manifold to 10 psi or less at closest burner to the boost pump.

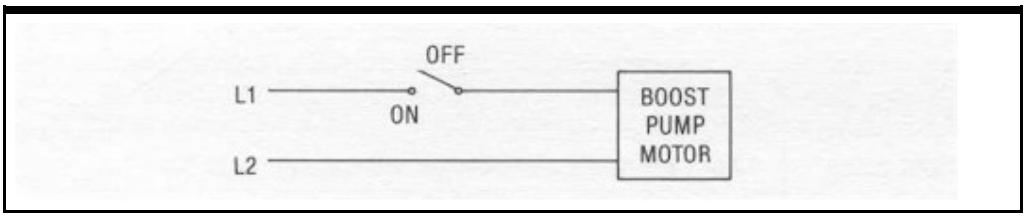


FIGURE 5 WIRING FOR CONSTANT OPERATION

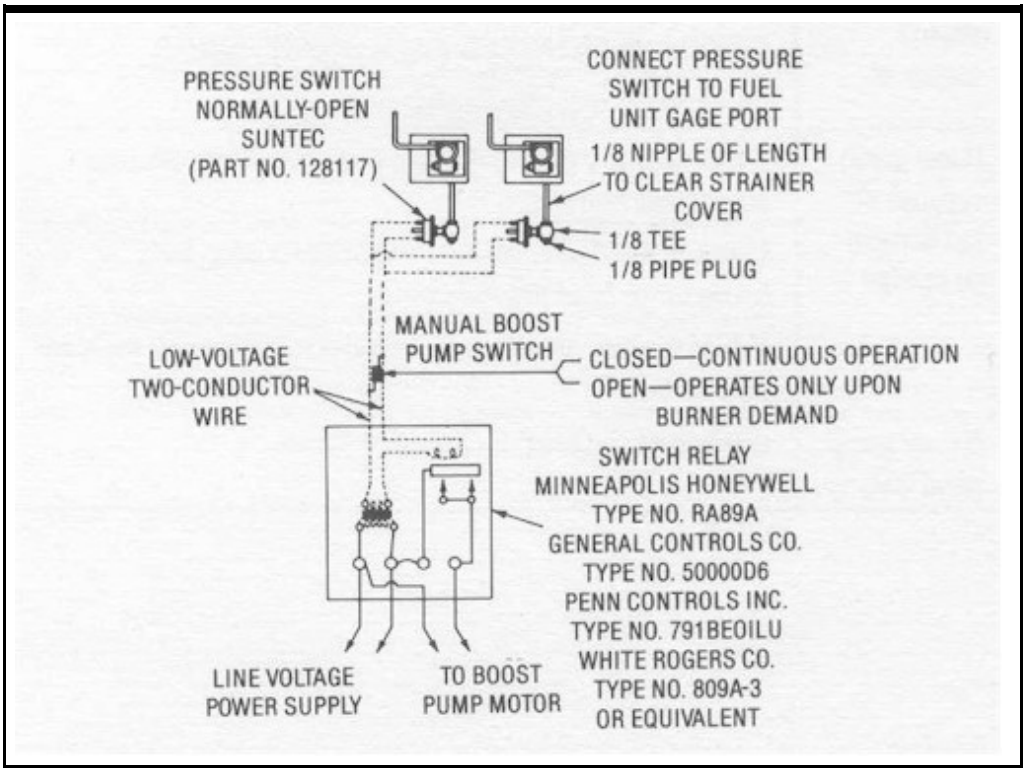


FIGURE 6 WIRING FOR INTERMITTENT OPERATION

3. Pressurized system - bleed manifold of all air.
4. All systems - bleed pumps starting with one closest to boost pump and proceeding to the furthest away.
5. System should be ready for normal service.

SERVICE

1. Check periodically for water accumulation.
2. Change filter (external) as needed.
3. Check pump strainer.
4. Periodically check for manifold pressure.

PROBLEM	SOLUTION
Boost pump doesn't run	Check electrical connections and supply; check for discharge and return line blockages.
Boost pump runs, but doesn't supply oil	Measure inlet vacuum. If too high, check inlet line, filter and valves.
	Check to see that by-pass plug is properly installed.
	Check to see that inlet line has no air leaks.
Boost pump supplies oil but burners do not fire	Check capacity of boost pump to see that it exceeds total burner requirements.
	Check to see that pressure rating of boost pump isn't exceeded by head requirements.
	In loop system, check to see if oil is passing through the stand pipe or riser.
Burner pump seals leaking	Check inlet line pressure to burner pumps.

PIPING

Correct piping is critical to long-term operation of any fuel oil system. Improper line sizing will not only cause present and future service problems, but can also cause premature failure of the components supplied by it.

SINGLE-PIPE OR ONE-LINE SYSTEM

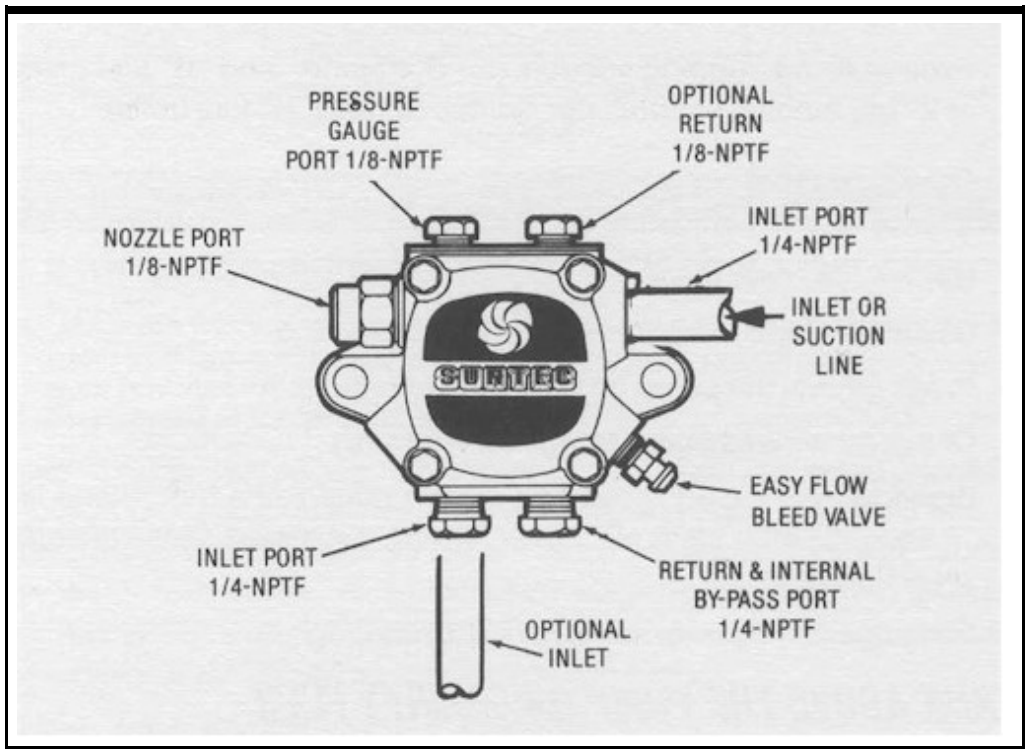


FIGURE 1

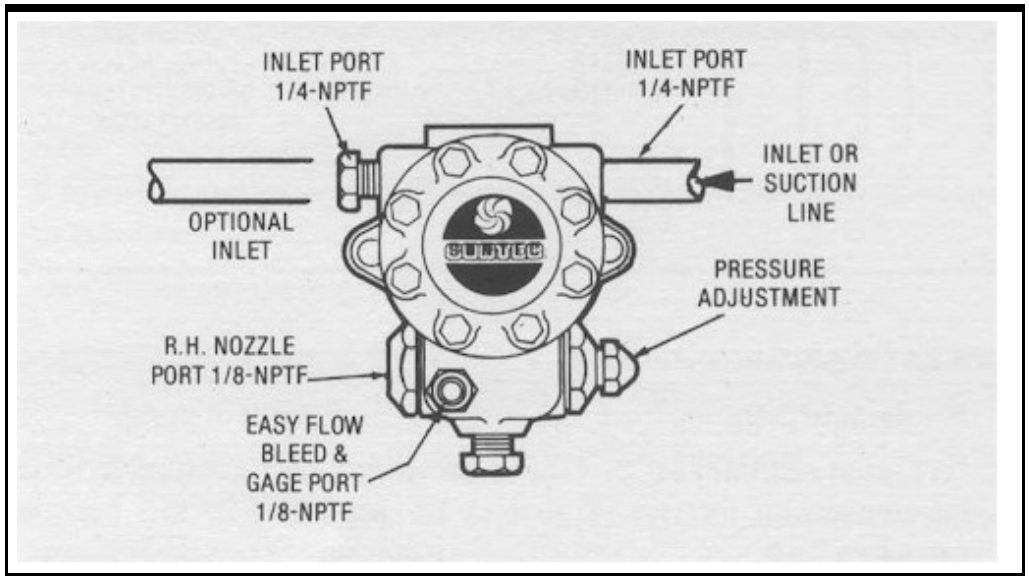


FIGURE 2

DO NOT

- Install by-pass plug. (Will damage seal.)
- Use compression fittings. (Will eventually leak.)
- Use teflon tape. (Will void warranty.)
- Use check valves. (Especially on gravity feed systems.) See Thermal Expansion, page III-12.
- Exceed 10 psi (manufacturer) or 3 psi (NFPA) inlet line pressure.
- Exceed 6" hg. running vacuum (for Suntec "A" and "B" fuel units) or 2" hg. running vacuum (for Suntec "J" and "H" fuel units.)

DO

- Use 37° JIC flare fittings.
- Use a non-hardening thread sealing compound.
- Prefill (prime) the pump on long runs to reduce dry running time.
- Check all unused pump fittings for tightness.
- Bleed system. Open bleed port approximately one turn. Bleed for 15 seconds after clear oil begins flowing out of port. Close bleeder valve tightly.
- See page IV-1 if pump fails to prime or deliver.

TANK ABOVE THE PUMP OR GRAVITY FEED

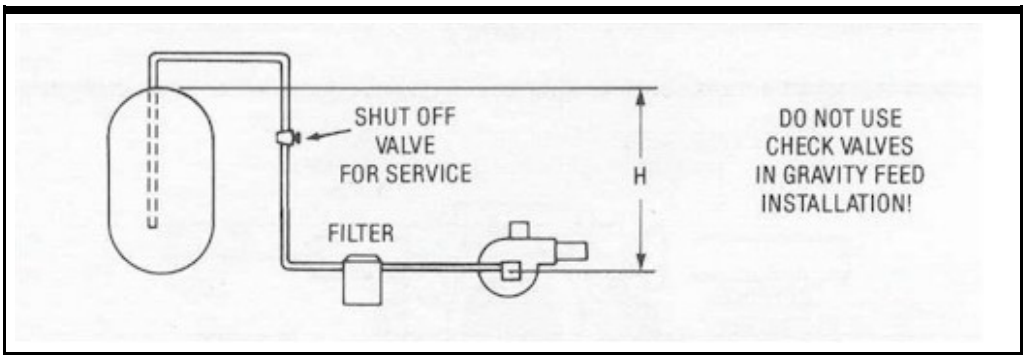


FIGURE 3

NOTES FOR FIGURE 3

1. H = vertical distance from top of tank to centerline of pump.
2. "H" must not exceed 27 feet to be within manufacturer's 10 psi inlet pressure limit, or 8 feet to be within NFPA's 3 psi inlet pressure limit.
3. See page II-3 for line sizing.

TANK BELOW THE PUMP OR LIFT FEED

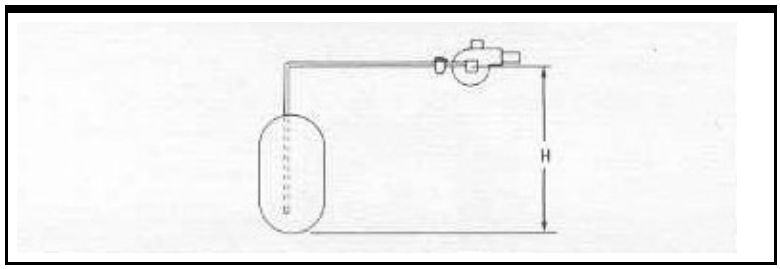


FIGURE 4

NOTES FOR FIGURE 4

1. H = vertical distance from bottom of tank to centerline of pump.
2. "H" must not exceed 8 feet for Suntec Model A and Model B fuel units or 2 feet for Suntec Model J and Model H fuel units.
3. See page II-3 for line sizing.

Even though pumps are capable of higher vacuums, good practice dictates that initial installation of Model A and B pumps and J and H pumps with a "F" piston do not exceed 6 inches of mercury vacuum on initial installation when installed single-pipe. J and H pumps without an "F" piston should not exceed 2 inches of mercury vacuum on initial installation when installed single-pipe.

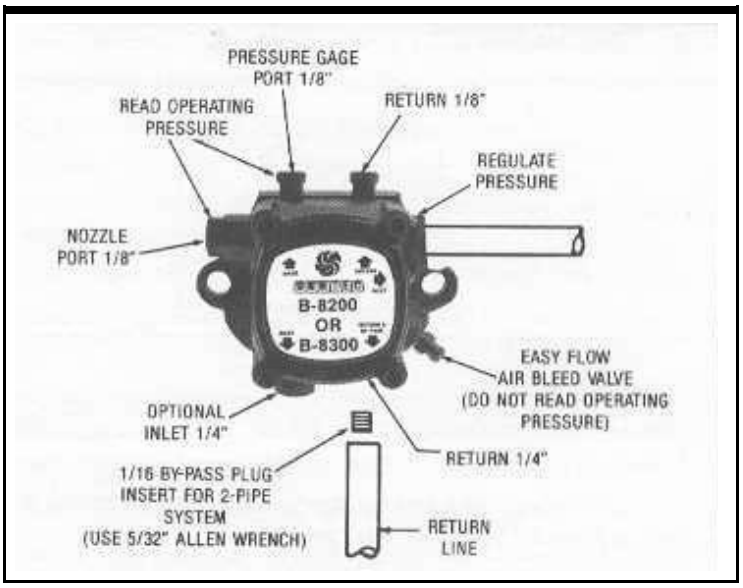
TWO-PIPE OR TWO-LINE SYSTEM

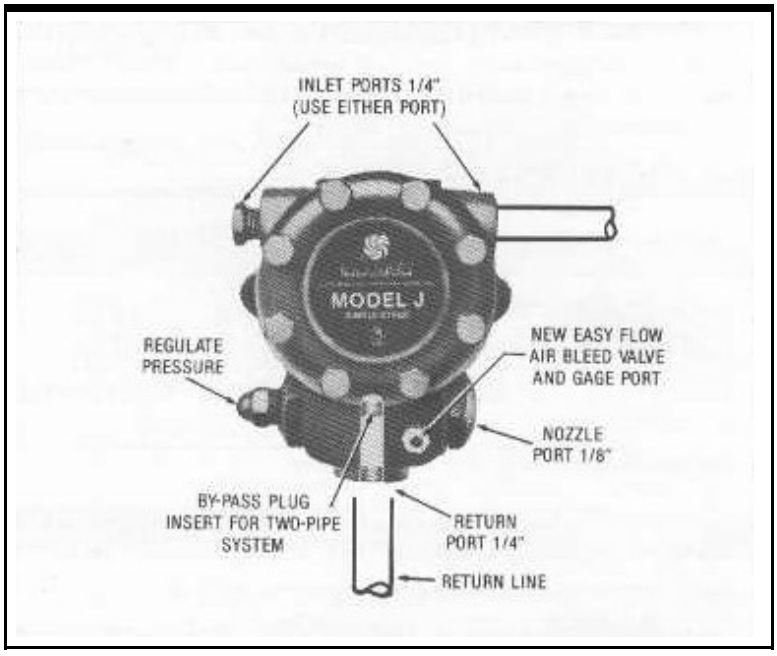
DO NOT

- Use compression fittings. (Will eventually leak.)
- Use teflon tape. (Will void warranty.)
- Exceed 10 psi (manufacturer) or 3 psi (NFPA) inlet and return line pressures.
- Use check valves in gravity feed systems.

DO

- Connect inlet or suction line to the fuel unit inlet port.
- Install the by-pass plug as shown. Failure to do so will caus improper fuel unit operation.
- Connect the return line to the fuel unit return port.
- Use 37° JIC flare fittings.
- Use a non-hardening thread sealing compound.
- Prefill (prime) the pump on long runs to reduce dry running time.
- Start fuel unit without bleeding (a properly-installed two-line system is self-priming).
- See page IV-1 if pump fails to prime or deliver.


PRESSURE GAGE PORT 1/8"
READ OPERATING PRESSURE
RETURN 1/8"
REGULATE PRESSURE
NOZZLE PORT 1/8"
B-8200
OR
B-8300
EASY FLOW AIR BLEED VALVE (DO NOT READ OPERATING PRESSURE)
OPTIONAL INLET 1/4"
RETURN 1/4"
1/16 BY-PASS PLUG INSERT FOR 2-PIPE SYSTEM (USE 5/32" ALLEN WRENCH)
RETURN LINE


INLET PORTS 1/4" (USE EITHER PORT)
MODEL J
REGULATE PRESSURE
NEW EASY FLOW AIR BLEED VALVE AND GAGE PORT
NOZZLE PORT 1/8"
BY-PASS PLUG INSERT FOR TWO-PIPE SYSTEM
RETURN PORT 1/4"
RETURN LINE

NOTE

A two-pipe or two-line system has three lines connected to the fuel pump. They are the inlet or suction line, return line, and nozzle line.

TANK ABOVE THE PUMP OR GRAVITY FEED

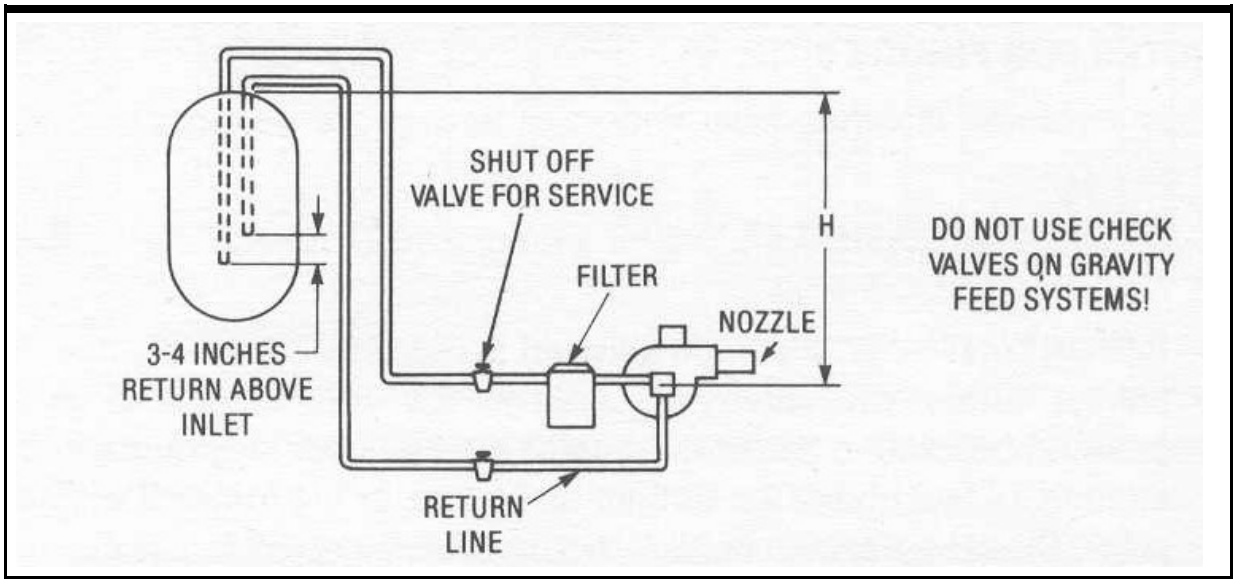


FIGURE 7

NOTES FOR FIGURE 7

1. H = vertical distance from top of tank to centerline of pump.
2. "H" must not exceed 27 feet to be within manufacturer's 10 psi inlet pressure limit, or 8 feet to be within NFPA's 3 psi inlet pressure limit.
3. See page III-7 for line sizing.
4. **IMPORTANT** - Single-pipe installation is recommended for gravity feed systems. It produces lower inlet line flow and longer filter life. For example: an "A-70" fuel unit firing 1 gph single-pipe has 1 gph flowing through the filter; an "A-70" pump firing 1 gph two-pipe has 19 gph flowing through the filter.

TANK BELOW THE PUMP OR LIFT FEED

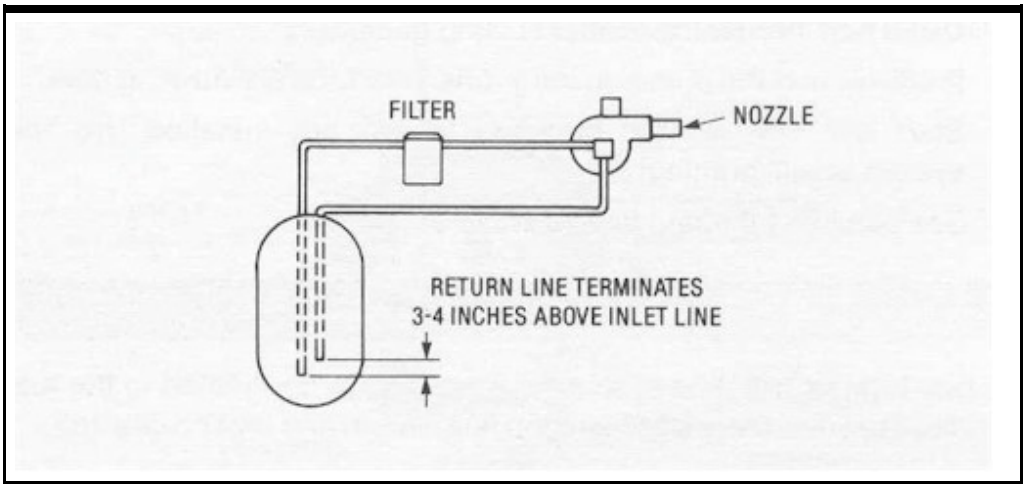


FIGURE 8

NOTES FOR FIGURE 8

1. H = vertical distance from bottom of tank to the centerline of the pump.
2. “H” must not exceed 12 feet for single-stage fuel units, or 18 feet for two-stage fuel units.
3. **IMPORTANT** - “H” distance allowed is reduced by the number of fittings, filters, and valves installed in the line. If the fuel lines extend higher than the centerline of the fuel unit, they should not exceed 24 feet above the bottom of the tank or the fuel unit will not prime (boost pump would be required). See page II-23.
4. System running vacuum should not exceed 12 in. hg. for single-stage fuel units or 17 in. hg. for two-stage fuel units.
5. **IMPORTANT** - Vacuum requirements are not limited by fuel unit capability. Fuel oil will boil or de-gas at vacuums as low as 10 in. hg. These bubbles can get into the nozzle line and cause a smoky or unstable flame. Suntec two-stage pumps are designed to prevent this with vacuums up to 17 in. hg.
6. See page III-7 for line sizing.

LINE SIZING · TWO-PIPE SYSTEMS

NEW INSTALLATIONS FOR NEW LINES

NOTE: The formulas in this section are set up to keep new installations within practical design limits for fuel pumps. Viscosity used for calculations is 57 saybolt secs. universal = 8.04 centipoise = 9.6 centistokes. Calculated lengths do not include valves, filters and an unusual number of 90° elbows.

Installations should avoid putting fuel oil where it is exposed to temperature extremes. The pour point limit for #1 and #2 fuel oils not seasonally-adjusted is 0°F and 20°F, respectively.

GEARSET/INLET LINE FLOW • GALLONS PER HOUR																	
Suntec Model No.	**A 7*** 3 GPH**	**A 7*** 7 GPH**	**B 82** 3 GPH**	**B 89** 3 GPH**	**B 89** 7 GPH**	**B 8850**	**B 8852**	**J2 J3**	**J4**	**J5**	**J6**	**H2 H3**	**H4**	**H5**	**H6**	**H7**	**H8**
Flow at 1725 rpm	16	-	18	-	-	-	-	18	22	29	38	26	31	36	42	69	98
Flow at 3450 rpm	17	20	21	25	28	33	39	38	46	60	78	61	69	79	93	-	-

LENGTH OF RUN (L)

The length of piping from tank to fuel unit is calculated using the following formulae which are based on flow properties for a given tubing size.

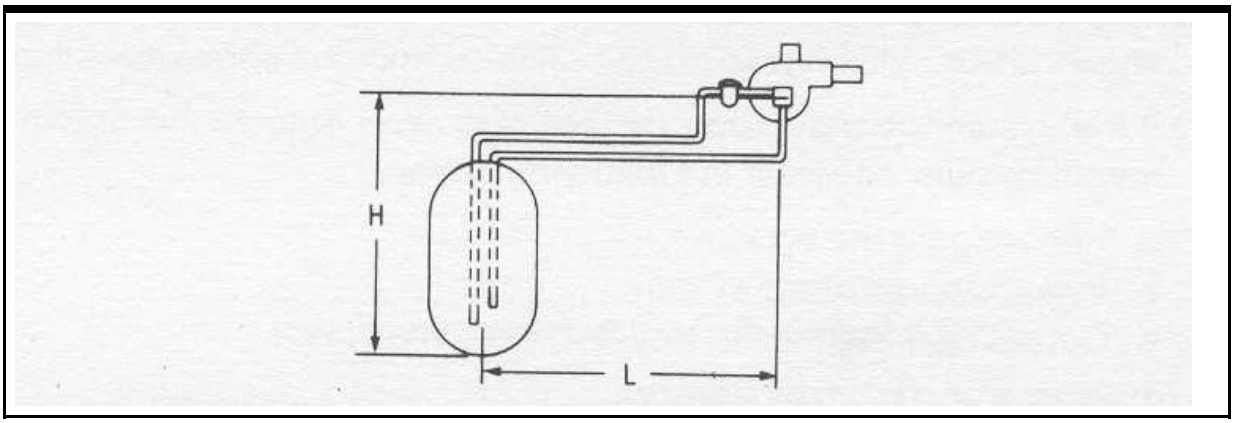


FIGURE 9

L - Horizontal run in feet from tank to fuel unit.
H = Vertical distance in feet from bottom of tank to centerline of pump.
Q = Gearset (or line) flow in gallons per hour (gph).
V = Vacuum in inches of mercury (in. hg.).

EXISTING INSTALLATIONS

The following formulae can be used to determine what the vacuum should be on

various line lengths of different size line tubing. The resulting figures may be used to determine if the configuration of an existing installation could cause system performance problems.

Tube Size O.D. (inches) (.035" wall)	Tank Below Pump		Tank Above Pump	
	Single-Stage	Two-Stage	Single-Stage	Two-Stage
3/8	$L = \frac{12-(.75H)}{.0086Q}$	$L = \frac{17-(.75H)}{.0086Q}$	$L = \frac{12+(.75H)}{.0086Q}$	$L = \frac{17+(.75H)}{.0086Q}$
1/2	$L = \frac{12-(.75H)}{.00218Q}$	$L = \frac{17-(.75H)}{.00218Q}$	$L = \frac{12+(.75H)}{.00218Q}$	$L = \frac{17+(.75H)}{.00218Q}$
5/8	$L = \frac{12-(.75H)}{.000785Q}$	$L = \frac{17-(.75H)}{.000785Q}$	$L = \frac{12+(.75H)}{.000785Q}$	$L = \frac{17+(.75H)}{.000785Q}$

Tube Size O.D. (inches) (.035" wall)	Vacuum*	
	Tank Below Pump	Tank Above Pump
3/8	V = L (.0086Q) + .75H	V = L (.0086Q) - .75H
1/2	V = L (.00218Q) + .75H	V = L (.00218Q) - .75H
5/8	V = L (.00785Q) + .75H	V = L (.000785Q) - .75H

*Does not include valves, filters, etc., in the line.

NOTES

1. Kinks or sharp bends in lines will increase vacuuum.
2. Return line pressure should not exceed 10 psi (manufacturer) or 3 psi (NFPA).
3. The installation instructions supplied with each Suntec fuel unit shows line lengths based on calculations from the above formulae.
4. If the system configuration causes operation outside the recommended limits, consider the following options:
   a. Reconfigure the system.
   b. Install a boost pump system.
   c. Contact the Suntec Factory Service Department.

ADD-ONS AND MULTIPLE UNITS

When adding or installing new fuel units to an existing system, good practice is to have separate lines for each system. If running separate lines is difficult, impractical and/or impossible, it may be necessary to tie a new system into an old one.

Before tying into an existing system, consider:

1. What the running vacuum of the present system is. (See Vacuum Testing, page IV-9.)
2. What the extra distance will be to the new fuel unit.

If a new identical fuel unit will be installed side-by-side with the existing unit, its addition will **at least** double the vacuum with both units running.

Line Sizing. Lines should be sized to have a **small enough** inside diameter to allow complete purging of air during priming or bleeding, and **large enough** to not cause excessive pressure drop or line losses which would cause the pump to operate with too high a vacuum.

Priority Controls. Relays which give operating preference to a specific unit, can be used to assure that only one fuel unit is operating at a time. For example, priority is usually given to a hot water heater rather than a furnace or boiler.

INSTALLING PRIORITY CONTROLS

Two options exist:

1. Less than ideal: Priority controls controlled by low voltage from the thermostat. Disadvantage: If the primary unit locks out on “safety,” the secondary system cannot automatically operate.
2. Preferred: Use a power relay to establish priority based on line voltage demand. Advantage: Allows the line voltage to be available to the secondary unit if a fault occurs in the primary unit. (Should be installed by a qualified electrician.)

SERVICING NON-RECOMMENDED EXISTING INSTALLATIONS

Occasionally, you will find existing installations which do not conform to good practice or proper installation. The correct procedure is to replace these piping configurations with correct piping. However, in the real world, this is sometimes impractical or financially impossible. The following information will help you identify and work with these types when you encounter them in the field.

MULTIPLE UNITS WITH UNDERSIZE OR OVERSIZE INLET MANIFOLDS • SINGLE-PIPE (TANK ABOVE OR BELOW FUEL UNITS)

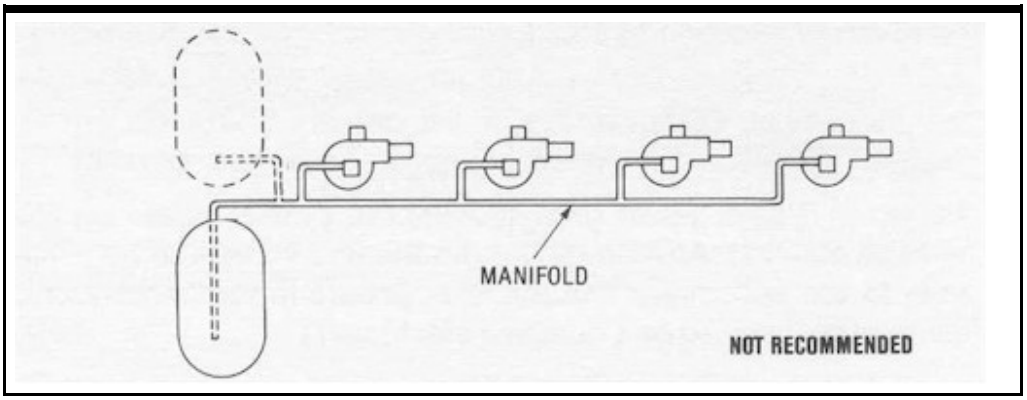


FIGURE 10

Line Sizing. The manifold or supply line must be sized to accommodate the total **firing rate** of all units connected to the manifold (A + B + C + D as shown above). See Installation Section for specific model, for single-line calculation formula.

Priming. Bleed or prime units beginning with the unit closest to the tank and working outward. Since priming this type of system would require extended operation of the fuel units with dry gear sets, the fuel unit should be filled with oil before beginning.

Recommendation. This type of system should be supplemented with a boost pump system to provide the proper oil supply to the fuel units. See Boost Pumps or Transfer Pumps, page II-23.

TWO-PIPE • *(TANK ABOVE OR BELOW FUEL UNITS)*

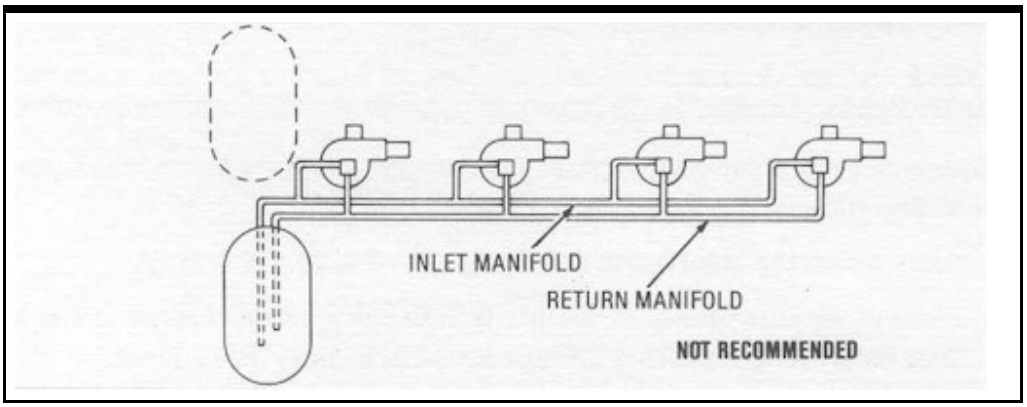


FIGURE 11

Line Sizing. The manifolds or supply lines must be sized to accommodate the total **gear set capacity** (not firing rate) or all units connected to the manifold (A + B + C + D, as shown above). See Line Sizing, page III-7, for fuel unit gear set capacities. If lines are undersized, they must be replaced, or use priority controls.

Return line manifold piping and input manifold piping must be the same size.

Priming. Return line must terminate below the surface of the oil in the tank to maintain prime.

Start or prime units beginning with the unit closest to the tank and working outward. Since priming this type of system would require extended operation of the fuel units with dry gear sets, the fuel unit should be filled with oil before starting.

DRAWBACKS

a. Problems with one unit affects all units.
b. Line sizes are a compromise.
c. Troubleshooting is more complicated.
d. Making and keeping system air-free is time-consuming.

RECOMMENDATIONS

a. Install individual lines to multiple units, or
b. Incorporate a boost pump system to supply adequate fuel to the multiple units. See Boost Pumps or Transfer Pumps, page II-23.

CHECK VALVES, OTHER VALVES AND THERMAL EXPANSION

Check Valves. A properly-installed fuel oil heating system does not require check valves for proper operation.

However, check valves are often used to compensate for deficiencies in oil line piping. For example:

a. Not having the return line submerged in the oil in the tank

b. Having vacuum leaks in the line due to using compression fittings, bad flare fittings, porous fittings, loose fittings or leaky lines.

Disadvantages:

Check valves increase the amount of vacuum the fuel unit must overcome to supply oil to the system and reduce the distance supply lines can be run.

When installed near the fuel unit, check valves cause turbulence and stripping of air from the oil, resulting in dirty and/or noisy combustion.

Do not use check valves in gravity feed (tank above pump) single-pipe systems, or in a system supplied by a boost or transfer pump. Thermal expansion can cause serious problems.

Thermal Expansion. Thermal expansion is a phenomenon in which a fluid increases in volume when heated.

When fuel oil is heated from 40°F to 70 °F, it will increase in volume by 1 - 1/2%. Since oil will only compress at a rate of 1/10%, thermal expansion will greatly increase the oil pressure in a closed system.

In a typical single-pipe system, an air pocket within the pump serves as a cushion against changes in pressure. In a gravity feed- or boost pump-supplied system, the air cushion is eventually absorbed, creating a hydraulically “hard” or closed system which is unable to absorb pressure increases.

EFFECTS OF THERMAL EXPANSION:

a. Leaks at pipe joints and fittings.
b. Broken pressure gages.
c. Leaks at filters.
d. Leaks at fuel unit seals.

CONDITIONS WHERE THERMAL EXPANSION CAN CAUSE PROBLEMS:

a. In single-pipe, dual-fuel systems (during alternate fuel operation).
b. Where ambient temperature around the supply line is higher than the fuel temperature (ceilings of industrial/commercial buildings, boiler rooms, mobile home enclosed furnace vestibules).

PREVENTION OF THERMAL EXPANSION PROBLEMS:

a. Install relief valves in problem areas (see Figure 14).
b. Do not use check valves.
c. Install an accumulator in the line.

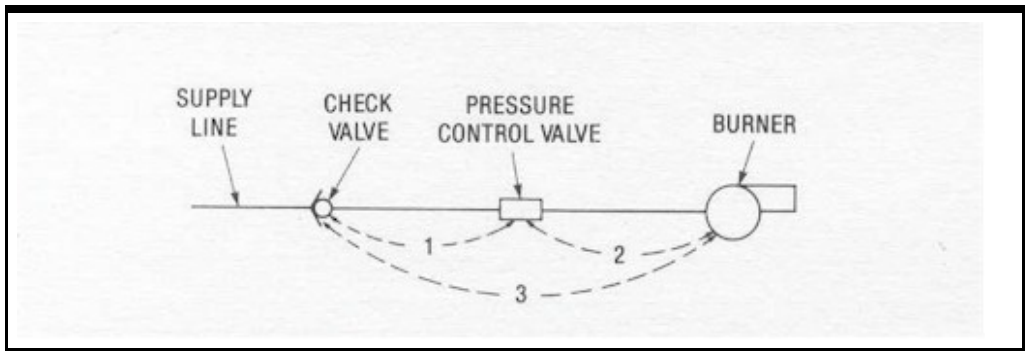


FIGURE 12 CLOSED OIL SYSTEMS

1. A closed system will occur between the check valve and the pressure control valve during burner off-cycle.
2. A closed system will occur between the pressure control valve and the burner pump, since the regulating valve in the pump is also a positive shut-off valve.
3. Since the regulating piston in the pump is also a positive shut-off valve, a closed system will occur during burner off-cycle even without the vacuum safety valve installed.

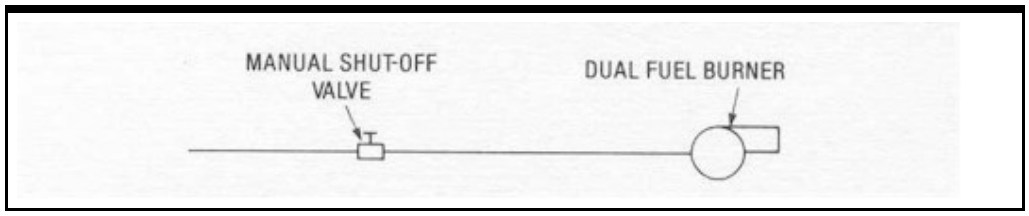


FIGURE 13 CLOSED OIL SYSTEM, DUAL-FUEL BURNER

1. A closed circuit will occur between the manual valve and the burner if the valve is closed during alternate fuel operation.

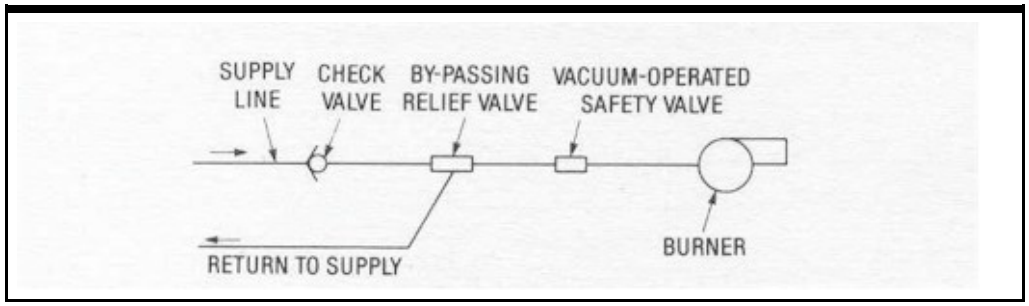


FIGURE 14 BY-PASSING RELIEF VALVE INSTALLATION

NOTE: All installations should be in compliance with local and national codes. Typical installation diagrams contained in this Technical Service Manual are for reference only.

SERVICE

Service on fuel units should not be attempted without the aid of good vacuum and pressure gages. Many system problems can be detected with the aid of these gages.

Service falls into two categories: routine and trouble.

ROUTINE · ANNUAL OR OTHER CHECK OUT

Check line filter and pump strainer for amount of contaminate. If close to needing service, replace to prevent a call-back in near future. If using inlet into the side of the pump, it isn't necessary to remove cover to check the strainer. Remove inlet line and view strainer through inlet opening. If it's clean there, it will be clean the rest of the way around.

If strainer is plugged, remove cover and clean strainer with a brush and clean fuel. Replace cover gasket before reinstalling.

System running vacuum should be checked as part of routine.

Running vacuum should not exceed:

- ✓ 6 inches mercury for single-stage one-pipe.
- ✓ 12 inches mercury for single-stage two-pipe.
- ✓ 17 inches mercury for two-stage two-pipe.
- ✓ Check and adjust system pressure, if necessary.
- ✓ Check CO_2 or O_2 and system draft.
- ✓ Check for smoke and adjust to a trace. Zero smoke is unclear as to where you are in adjustment.
- ✓ Check for leaks at fittings and filters. Correct any leaks that are found.

TROUBLE CALL

In response to a trouble call, approach the problem in a logical and systematic sequence. Jumping to a conclusion can sometimes temporarily fix the problem, but not uncover the root cause of the problem. An example is if there is water in the fuel, which causes the pump to fail and you replace the pump only, you will eventually be called back to replace the new pump.

In addition to the mechanical tools required, you also must have gages (pressure and vacuum) and suitable combustion analyzers.

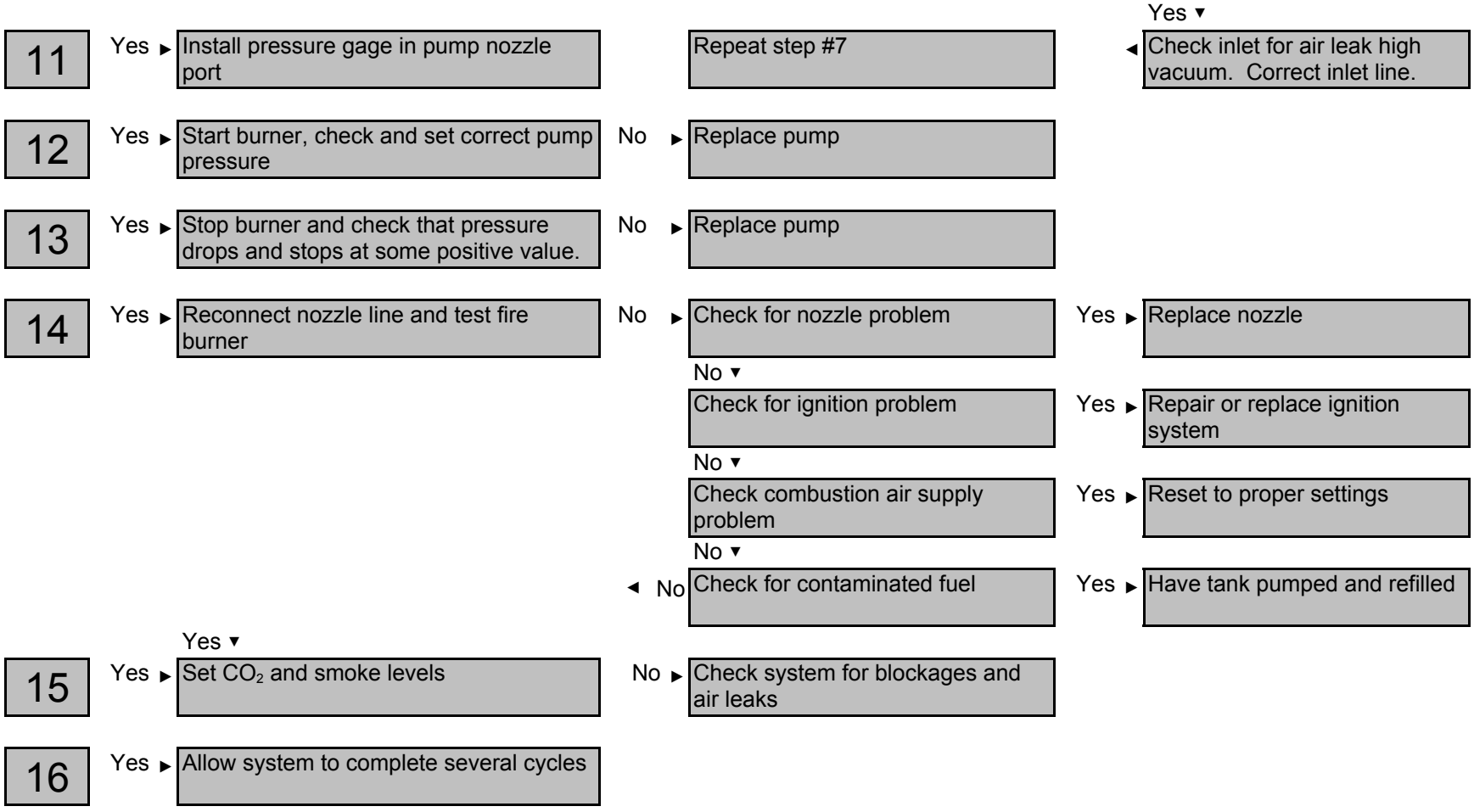
SYSTEM TROUBLESHOOTING • *DIAGNOSTIC FLOW CHART*

Follow a logical equence of troubleshooting from the no-heat call through to system operational using the following chart or similar sequence.

Step								
1	▸	No heat						
2	Yes ▸	Check for oil in tank	No ▸	Have oil delivered				
3	Yes ▸	Check to see that all valves are properly positioned (open or closed)	No ▸	Set valves to correct position				
4	Yes ▸	Check for line voltage at primary control	No ▸	Check and correct electrical supply				
5	Yes ▸	Check to see that thermostat is calling for heat	No ▸	Set, fix or replace thermostat				
6	Yes ▸	Check combustion chamber for excess oil	Yes ▸	Clean, remove or replace combustion chamber				
7	No ▸	Disconnect nozzle line from burner. Place container under nozzle line and start burner.		If rust or bacteria in pump, fuel tank has water in it and need attention:	No or Yes ▸	Replace Pump		
				Yes ▲				
8	Yes ▸	Motor comes up to speed. Audible click when start windings drop out.	No ▸	Check for seized pump	No ▸	Repair or replace motor and/or primary control		
9	Yes ▸	Ignition working	No ▸	Repair or replace ignition system		Replace pump		
						No ▲		
10	Yes ▸	Steady stream of oil from pump	No ▸	Check for clogged strainer (in pump) or filter (external)	No ▸	Check vacuum capability of pump (Technical Bulleting #223)		
						Yes ▼		

SYSTEM TROUBLESHOOTING · *DIAGNOSTIC FLOW CHART (cont'd.)*

Step



CAUSE	REMEDY
NO OIL FLOW AT NOZZLE	
Oil level below intake line in supply tank.....	Fill tank with oil.
Clogged strainer or filter	Remove and clean strainer. Replace filter element.
Clogged Nozzle	Replace nozzle.
Air leak in intake line	Tighten all fittings in intake line. Tighten unused intake port plug. Check filter cover and gasket.
Restricted intake line (high vacuum reading)	Replace any kinked tubing and check any valves in intake line. Check form 440100 for line sizes.
A two-pipe system that becomes airbound	Check for and insert by-pass plug. Make sure return line is below oil level in tank.
A single-pipe system that become airbound	Loosen gage port plug or easy-flow valve and bleed oil for 15 seconds after foam is gone in bleed hose. Check intake line fittings for tightness. Check all pump plugs for tightness.
Slipping or broken coupling	Tighten or replace coupling.
Rotation of motor and fuel unit is not the same as indicated by arrow on pad at top of unit	Install fuel unit with correct rotation. See form no. 440100.
Frozen pump shaft	Return unit to approved service station or Suntec factory for repair. Check for water and dirt in tank.

CAUSE	REMEDY
OIL LEAK	
Loose plugs or fittings	Dope with good quality thread sealer. Retighten.
Leak at pressure adj. screw or nozzle plug	Washer may be damaged. Replace with washer or o-ring.
Blown seal (single-pipe system)	Check to see if by-pass plug has been left in unit. Replace fuel unit.
Blown seal (two-pipe system)	Check for kinked tubing or other obstructions in return line. Replace fuel unit.
Seal leaking	Replace fuel unit.
Cover	Tighten cover screws or replace damaged gasket.
NOISY OPERATION	
Bad coupling alignment	Loosen fuel unit mounting screws slightly and shift fuel unit in different positions until noise is eliminated. Retighten mounting screws.
Air in inlet line	Check all connections. Use only good flare fittings.
Tank hum on two-pipe system and inside tank	Install return line hum eliminator in return line.
PULSATING PRESSURE	
Partially clogged strainer or filter	Remove and clean strainer. Replace filter element.
Air leak in intake line	Tighten all fittings.
Air leaking around cover	Be sure strainer cover screws are tightened securely. Check for damaged cover gasket.

CAUSE	REMEDY
LOW OIL PRESSURE	
Defective gage	Check gage against master gage or other gage.
Nozzle capacity is greater than fuel unit capacity	Replace fuel unit with unit of correct capacity. See form no. 2100 for GPH, psi, and R.P.M.

IMPROPER NOZZLE CUT-OFF

To determine the cause of improper cut-off, insert a pressure gage in the nozzle port of the fuel unit. After a minute of operation, shut burner down. If the pressure drops from normal operating pressure and stabilizes, the fuel unit is operating properly and air is the cause of improper cut-off. If, however, the pressure drops to 0 psi, fuel unit should be replaced.

NOTE: The A-70 pump circuitry is designed to give a high cut-off of superb quality. Never use the amount of pressure drop as an indication of the quality or speed of cut-off.

Filter leaks	Check face of cover and gasket for damage.
Strainer cover loose	Tighten four screws on cover.
Air pocket between cut-off valve and nozzle	Run burner, stopping and starting unit, until smoke and after-fire disappears.
Air leak in intake line	Tighten intake fittings. Tighten unused intake port and return plug.
Partially-clogged nozzle strainer	Clean strainer or change nozzle.
Leak at nozzle adaptor	Change nozzle and adaptor.

FIELD TESTING FUEL UNITS

INTRODUCTION

Fuel units are sized to an application based on their pressure, vacuum, and flow ratings.

With today's high efficiency furnaces and boilers, it is extremely important to check these parameters when the initial installation is made and also during later service calls to assure that high efficiency operation is being maintained.

It is also important to check fuel unit pressure and vacuum levels during trouble calls to help differentiate pump problems from system problems.

VACUUM TEST • *FOR FUEL UNITS AND INLET LINES*

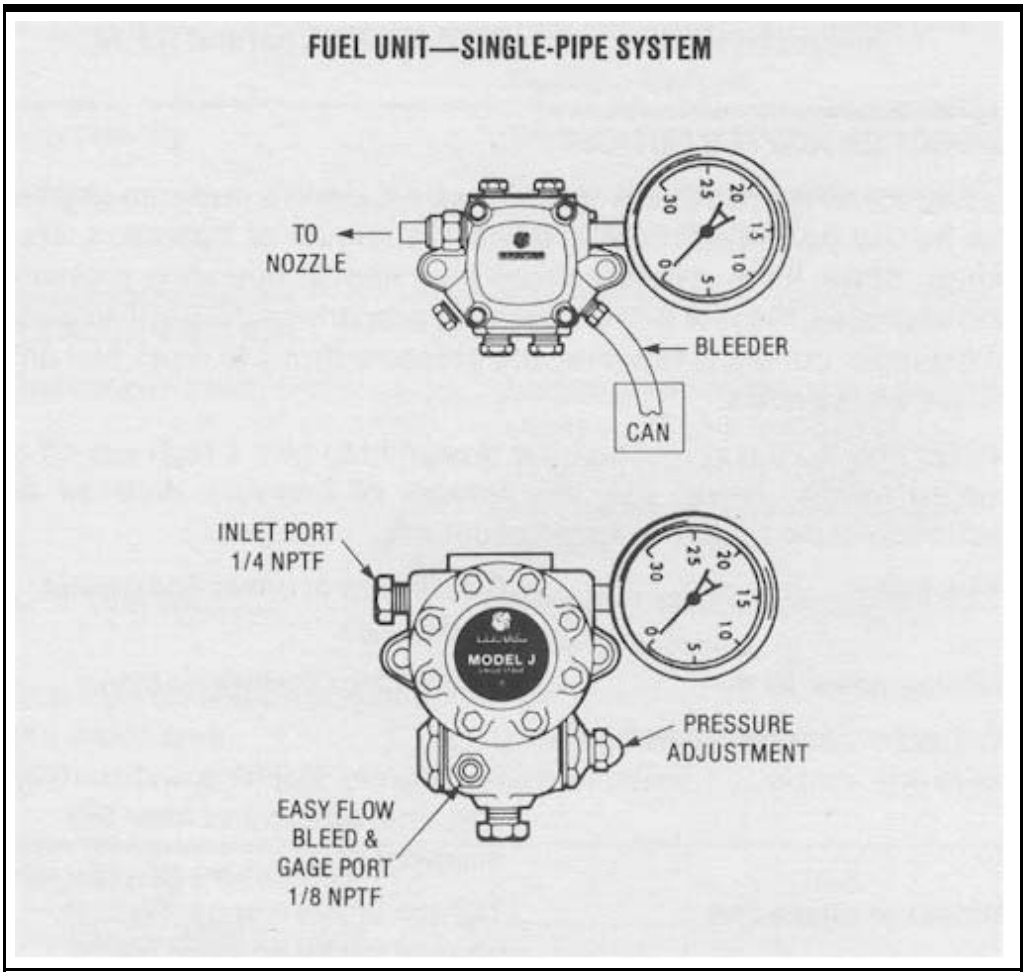


FIGURE 1 VACUUM GAGE LOCATION FOR SINGLE-PIPE SYSTEM

Step 1. Remove inlet line from fuel unit and install vacuum gage in the inlet port (see Figure 1). If unit has been running dry, pour oil into pump prior to testing.
Step 2. Turn burner ON and open bleed.
Step 3. When vacuum reaches 15 in. hg.*, close bleed port.
Step 4. Turn burner OFF. Pump should hold vacuum level for five minutes*.

***NOTE:** If fuel unit cannot attain 15 in. hg. or hold that vacuum level for five minutes, it should be repaired or replaced.

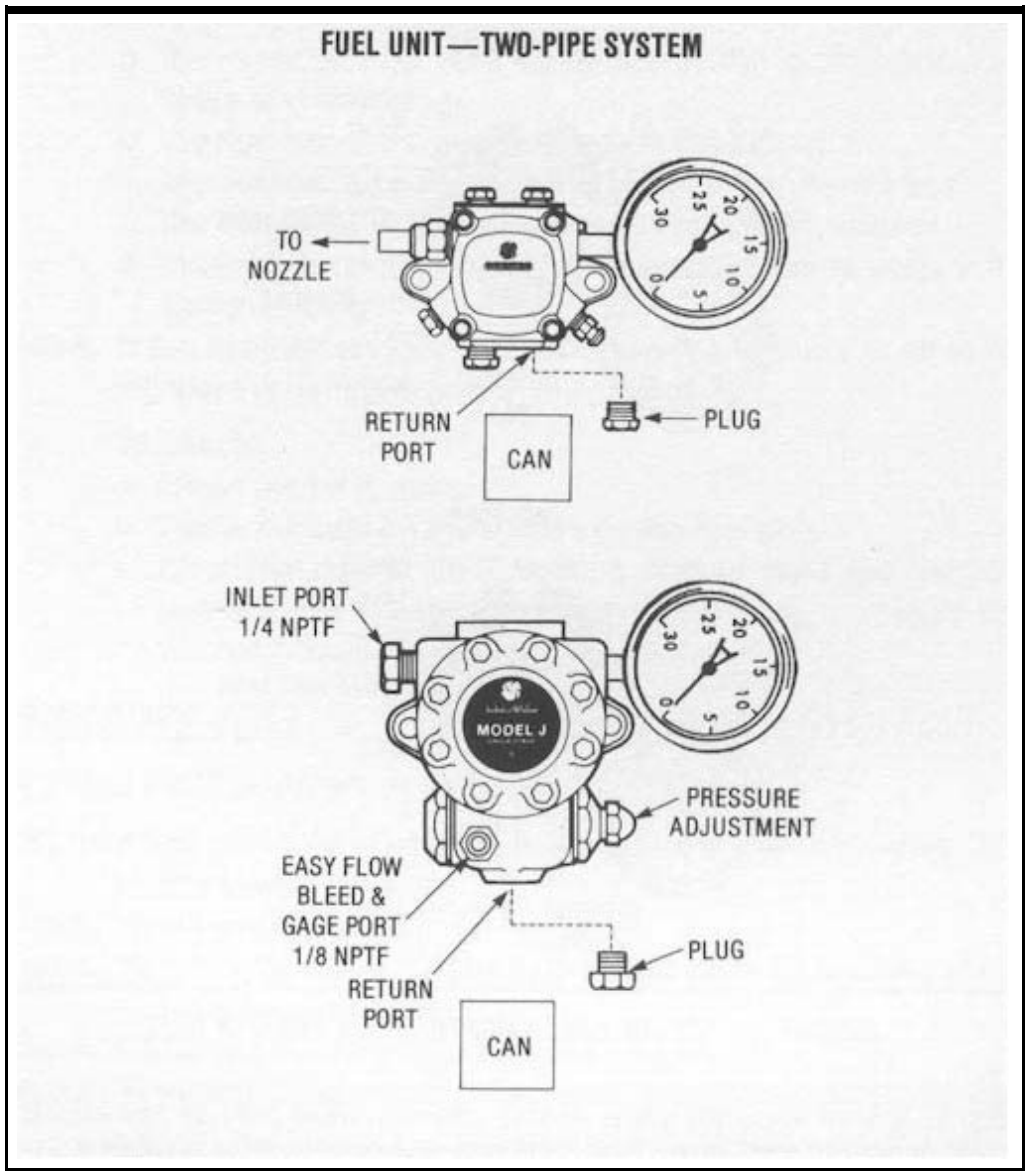


FIGURE 2 VACUUM GAGE LOCATION FOR TWO-PIPE SYSTEM

Step 1. Remove inlet line from fuel unit and install vacuum gage in the inlet port (see Figure 2).
Step 2. Remove return line.

Step 3. Turn burner ON.
Step 4. When vacuum reaches 15 in. hg.*, plug return port and turn burner OFF.
Step 5. Pump should hold vacuum level for five minutes*.

***NOTE:** If fuel unit cannot attain 15 in. hg. or hold that vacuum level for five minutes, it should be repaired or replaced.

***VACUUM TEST** • *FOR SYSTEM*

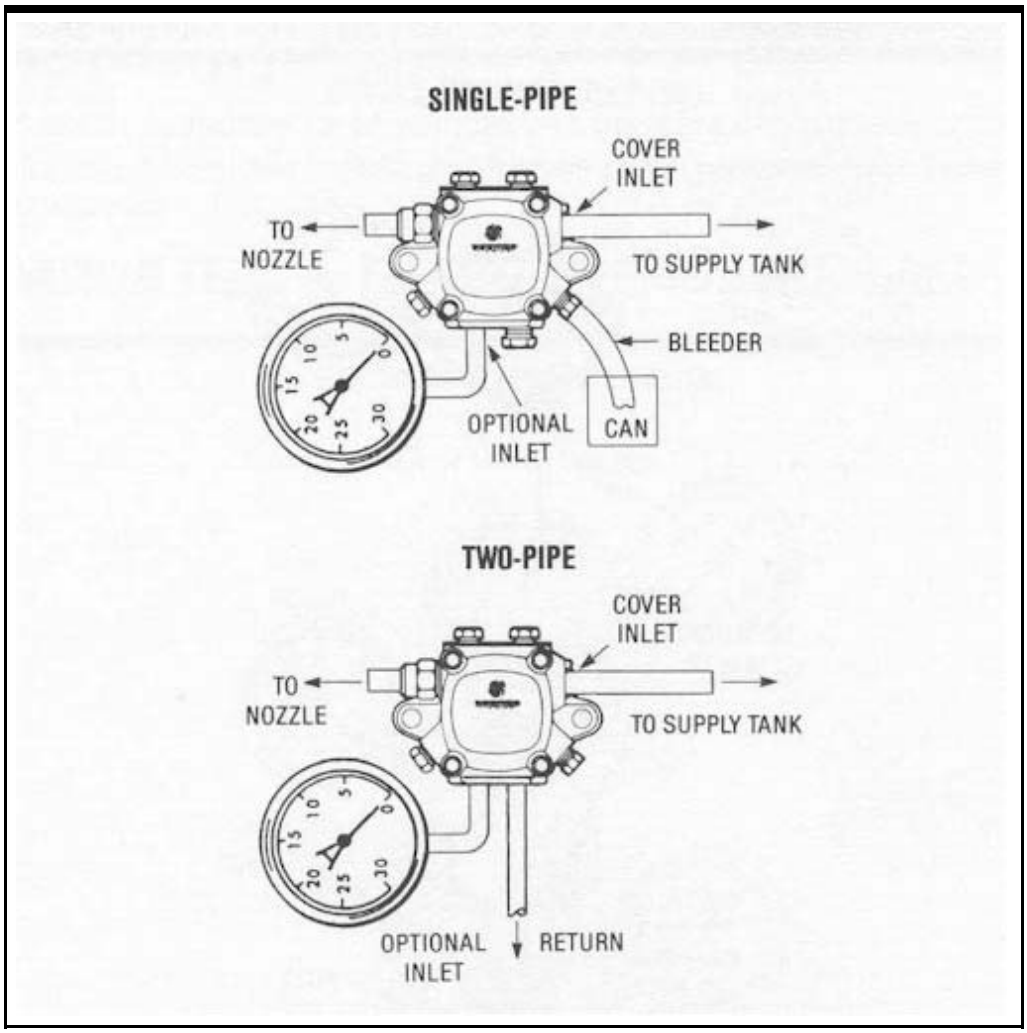


FIGURE 3 VACUUM GAGE LOCATION FOR SYSTEM TEST

Step 1. Install vacuum gage in the optional inlet port or tee into the supply line at the fuel unit. (If the optional inlet is used for the supply line, install the gage in the cover inlet. See Figure 3.)
Step 2. Turn burner ON and bleed the fuel unit (if one-pipe system).
Step 3. Close bleed valve and read gage. Readings should be as follows:

	SINGLE-STAGE		*TWO-STAGE*	
	Model A	**Model J**	**Model B**	**Model H**
Single-Pipe System	6 in. hg.	2 in. hg.	6 in. hg.	2 in. hg.
Two-Pipe System	12 in. hg.	12 in. hg.	17 in. hg.	17 in. hg.

Step 4. **If the gage reading exceeds the level indicated** for the fuel unit being used, check the piping and the system layout (refer to Suntec installation bulletins* for details).

Step 5. **If the lift and run is not excessive for the fuel unit model,** the problem could be caused by

a. the number and type of bends in the piping (includes kinks and flattening),
b. the number and types of fittings in the piping,
c. the number, type, and condition of filters and strainers
d. the number and type of valves in the system, and/or
e. the level of contaminate build-up on the inside walls of the system piping.

Step 6. **If the vacuum level is NOT excessive,** and there is air in the oil, there is usually a leak in the piping.

To check:

a. Close the tank valve,
b. Pull a vacuum on the system by the fuel unit,
c. Shut the burner OFF. System should hold the vacuum level for five minutes. If system is two-pipe, the return line will have to be closed off at shutdown.

PRESSURE TEST • *FOR FUEL UNITS AND SYSTEMS*

SYSTEM PRESSURE WITH SYSTEM OPERATING

Step 1. If fuel unit is on a **positive head system,** shut tank valve OFF before installing gage.

Step 2. Install gage in **gage** port.

Step 3. Turn burner ON if pump is on **single-pipe lift system,** bleed pump at the bleed valve.

Step 4. Observe gage (disregard needle “jiggling”).

Step 5. If reading is high or low, readjust pressure adjustment screw.

NOTE: On Model J or Model H fuel units, there may be some leakage with the acorn nut removed. This will stop when the nut is replaced.

Step 6. Turn burner OFF. The pressure should fall to zero or to the amount of head on the fuel unit.

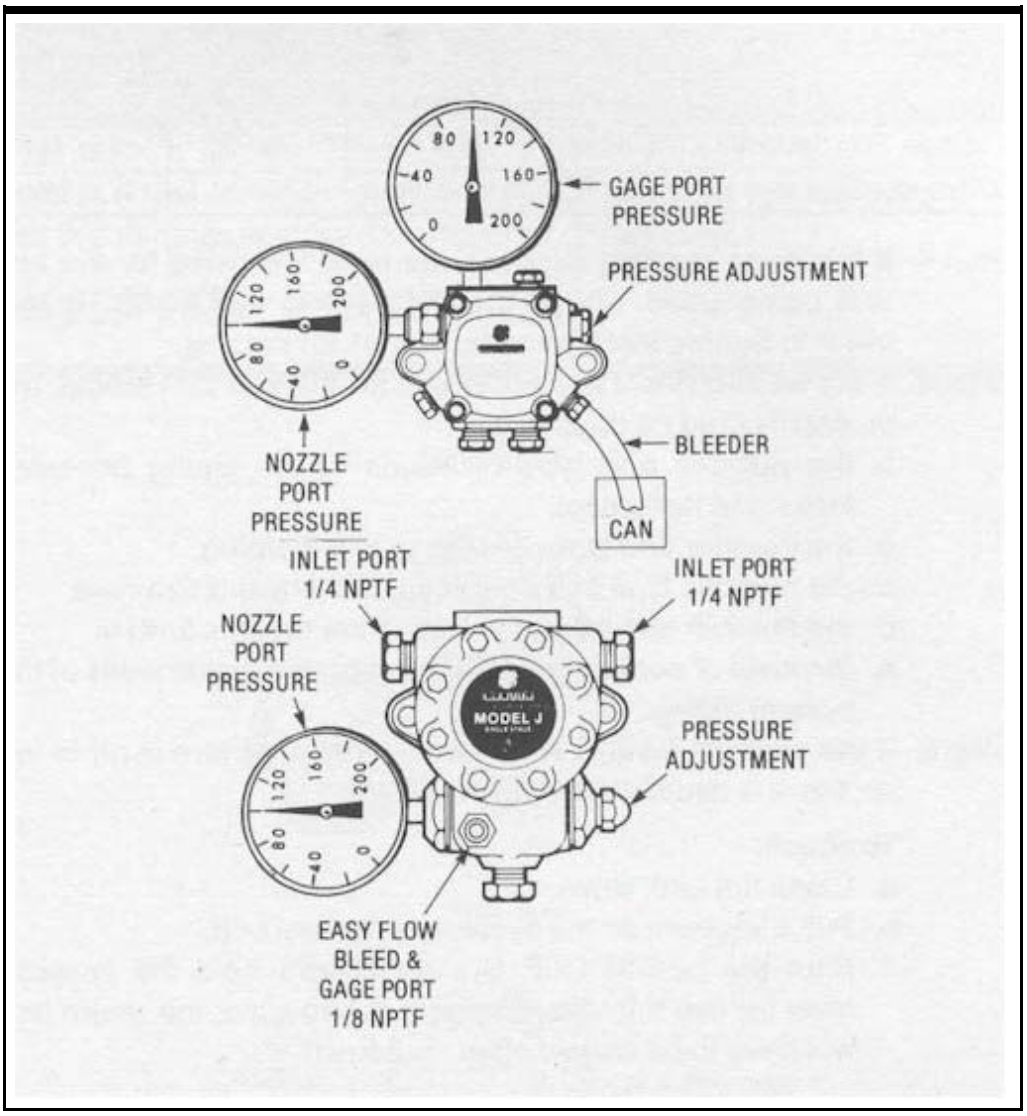


FIGURE 4 PRESSURE GAGE LOCATIONS FOR OPERATING PRESSURE TEST

FUEL UNIT OPERATING AND CUT-OFF PRESSURE

Step 1. Install gage into **nozzle** port.
Step 2. Turn burner ON and observe gage.
Step 3. Adjust pressure, if necessary.
Step 4. Turn burner OFF and observe gage. Pressure should drop to 80% or higher.
Step 5. If pressure drops below 80% or continues to decay, the fuel unit has faulty cut-off and should be repaired or replaced.

NOTE: A and B model pumps could theoretically have a cut-off pressure of less than 80%. The important operation is that it drops to some value and stops.

STRAINERS - FIELD SERVICE

Fuel unit strainers are intended as a **back-up** to, not a replacement for, proper system filtering.

Clogged strainers restrict oil flow into the gear set, cause fuel units to operate at higher vacuum and eventually fail. To diagnose a clogged strainer before it causes fuel unit failure, it must be removed and visually inspected. If a strainer **looks** clogged, it usually is, and should be cleaned or replaced.

IMPORTANT NOTE: Current regulations on the use of asbestos in gasket materials require that new non-asbestos gaskets be installed any time a fuel unit cover is removed. Make this a common practice to avoid expensive call-backs for that purpose.

STRAINER IDENTIFICATION

MODEL J AND MODEL H FUEL UNITS

Strainer models are designed by the first character following the gear size designation in the fuel unit model number, as indicated below:

Examples:
J3PBN-C200H-4 "P" Strainer
JA2BA-100 "B" Strainer

Strainer Model Designation	Nozzle Capacity Rating
A	No strainer (used in certain lube pumps)
B	7 gph (metal frame)
C	4.5 gph (obsolete, use B or N)
N	7 gph (plastic frame)
P	Unlimited (do not use in Models J7, J8, H7, H8)
K	Unlimited (requires spacer between pump body and cover)

MODEL A AND MODEL B FUEL UNITS

Strainer models are designated by the first character following the gear size designation in the fuel unit model number, as indicated below:

Examples:
A2VA-7116-4 "V" Strainer
B2TA-8851-5 "T" Strainer

Strainer Model Designation	Nozzle Capacity Rating
V	3 gph
Y	7 gph
T	16 gph
G	23 gph

IMPORTANT - DO NOT use a strainer which is too long for the cover (indicated by a 1/8" or more cover gap when spring is fully-compressed). Forcing would crush the strainer body and allow contaminants to get into the pumping mechanism.

STRAINERS AS A DIAGNOSTIC INDICATOR

What you see in a strainer can be an indicator of what conditions may exist within the system:

a. **Clogged strainer.** Primary filter has failed or is missing.
b. **Sludge on strainer.** Water in the tank, allowing biological growth.
c. **Rust flakes on strainer.** Rusted tank or components.

Field replacement of 3 gph- and 7 gph-rated strainers - Figure 1. (All models and revisions of Model A70 and model B80 fuel units.)

To simplify field replacement and improve overall strainer efficiency, only two strainer models are offered for replacement in standard Model A and Model B fuel units. As shown, a spring is required in some instances to compensate for the difference in strainer height and cover depth (see Figure 1).

Model Series	Strainer Designation	Capacity (GPH)	Model Revision*	Date Code	Cover Depth	Strainer Part No.	Spring Part No.
A	V	3	All	All	1.133"	3715732	Not Req.
A	Y	7	-	Y82 & Earlier	1.345"	3715732	3773231/3754732
A	Y	7	-	D82 & Later	1.620"	3715744	Not Req.
B	V & Y	3 & 7	-2, -3, -4	All	1.345"	3715732	3773231/3754732
B	V & Y	3 & 7	-5	All	1.620"	3715744	Not Req.
B	T	16	All	All	1.620"	3715742	Not Req.
B	G	23	All	All	1.620"	3715746	Not Req.
* Model Revision = last number of model number EXAMPLE: B2VA-8216-5							

FIGURE 1 STRAINER REPLACEMENT

Installation of strainer part no. 3715732 in medium-height covers*

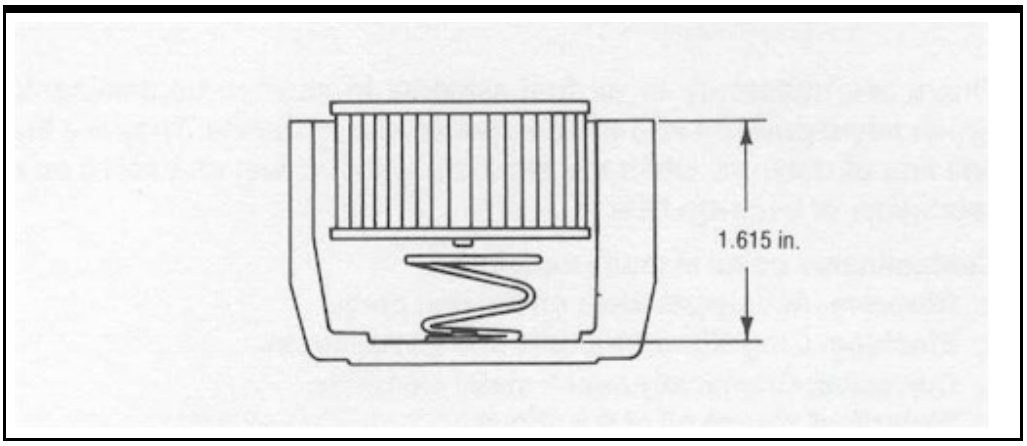


FIGURE 2 STRAINER INSTALLATION

Step 1. Set spring (part no. 3773231 or 3754732) in cover with large coils up.
Step 2. Set strainer (part no. 3715732) on large coil.
Step 3. Install new gasket.
Step 4. Slide cover over gearset.

FILTERS AND FILTRATION

Filters are necessary in all fuel systems to capture contaminants which might develop and create operational problems. They are the first line of defense, while the strainers within a fuel unit serve as a secondary or back-up filter.

Contaminants come in many varieties:

a. **Abrasive**. Accelerate wear on moving parts.
b. **Blocking.** Clog filters, strainers, and oil passages.
c. **Corrosive.** Chemically attack metal elements.
d. **Biological.** Cause all of the above.

Relative contaminant size:

a. Smallest particle visible to the human eye = 40 microns.
b. Bacteria = 2 microns
c. 1 micron = .000039 inch.
d. 100-mesh screen opening = .0059 inch = 149 microns.

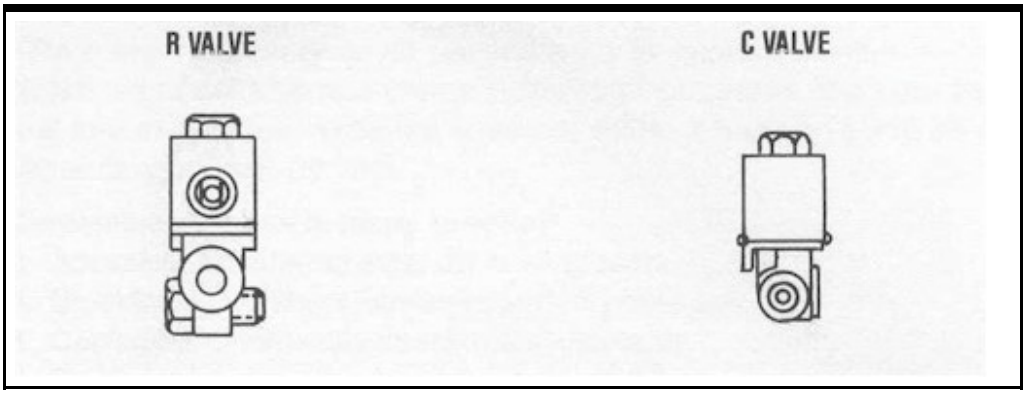
Contamination notes:

a. If filters require changing more than once a year, the filter is too small or the fuel system is too dirty.
b. If the fuel system is dirty, it should be pumped out, treated and refilled with clean oil.
c. If moisture is present, it can rust the fuel system and parts, and provide a breeding ground for bacteria.
d. If the fuel tank is treated with a bacticide, use only the recommended amount. Too heavy a concentration can cause the fuel unit to become inoperative.
e. When replacing filter elements, care should be taken to not introduce the contaminant downstream to the fuel unit.
f. If a filter element has collapsed, the fuel unit and lines must be flushed prior to resuming burner operation.
g. If filter has a screen in it, make sure it is non-corroding material. Some are, and some are not.

Field notes:

a. Some filter elements will cause outgassing of fuel oil at low flows and relatively low vacuums (1 - 2 in. hg.). This usually appears as a loss of prime on one-pipe installations. A field-cure for this is to shut off the tank valve while priming the pump and put as much vacuum as possible on filter. Open the tank valve and resume normal priming.
b. When changing filters, take care not to introduce contaminate from dirty element into down-stream piping and fuel pump.
c. High vacuums across a filter element that appears to be clean can be caused by greasy bridging-type contaminant.

SOLENOID VALVES - SERVICE



INSTALLATION

Model R valves mount directly into the nozzle port of the fuel unit.

Model C valves mount to the burner chassis or otherwise remote from the fuel unit.

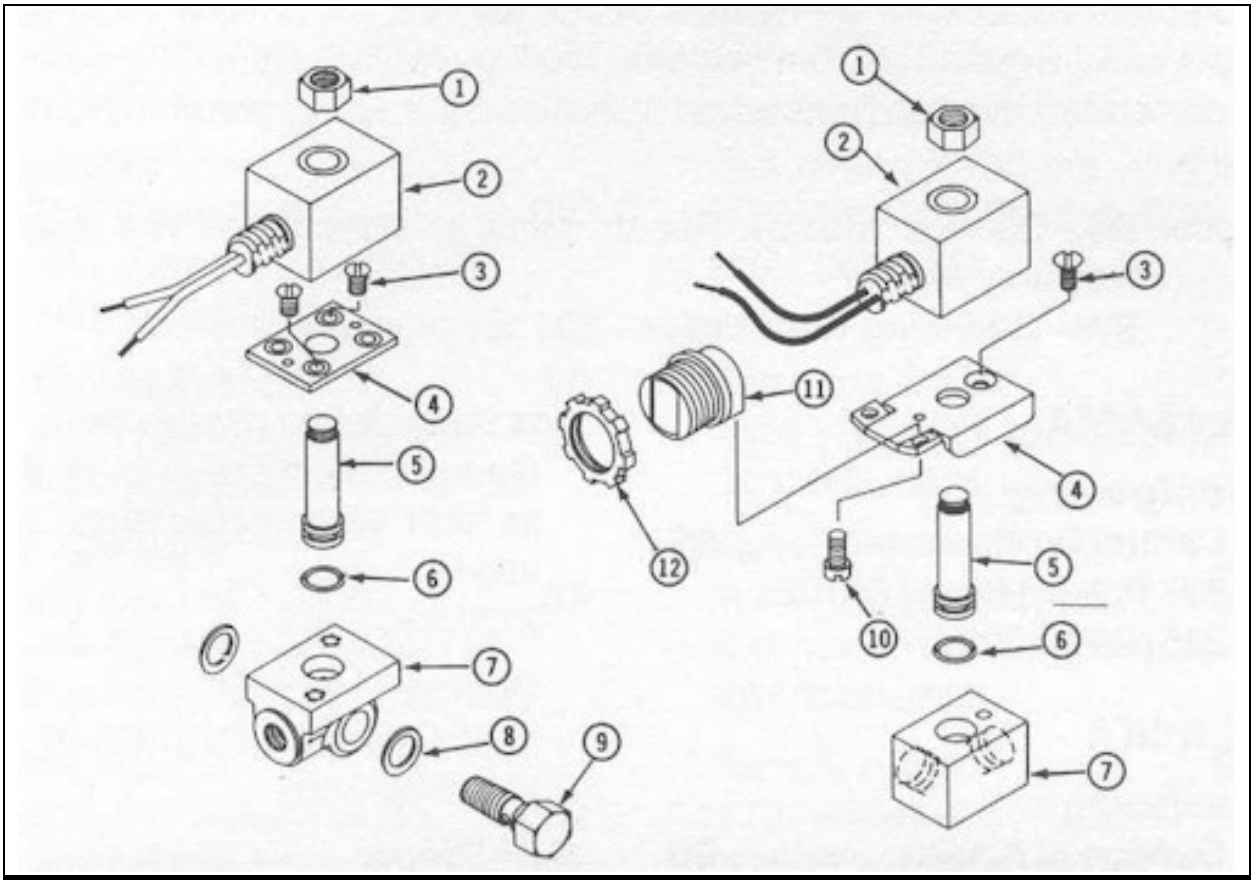
OPERATIONAL CHECK

Step 1. Remove nozzle line at the burner assembly end and place into container (to catch oil).
Step 2. Start burner and watch for oil to run from the open line. If YES, go to Step 9. If NO, go to Step 3.
Step 3. Turn burner OFF.
Step 4. Check for power to the coil. If YES, go to Step 5. If NO, repair electrical supply and recheck.
Step 5. Remove nut which holds the coil into the valve asembly.
Step 6. Remove coil from valve and slide it over an insulated handle screwdriver.

IMPORTANT: to apply power to the coil without a screwdriver (or other magnetic material) in the center hole will cause the coil to overheat, swell and fail.

CAUTION: Even though the coil is fully-insulated, care should be exercised to avoid touching the coil when energized, except with insulated tools.

Step 7. Apply power to the coil. You should feel vibrations and/or magnetic pull on the screwdriver. If YES, go to Step 8. If NO, replace coil and go to Step 2.
Step 8. Replace tube assembly or complete valve assembly.
Step 9. Remove power from coil and start burner. Check to see if oil is passing through the valve. If YES, replace tube assembly or valve assembly and go to Step 1. If NO, valve is performing satisfactorily.



Item No.	Description`	Part Order Number	
		"R" Valve	"C" Valve
1	Coil Nut	3753818	3753818
2	Coil for:		
	R642N	3713642	-
	R641D	3713809	-
	R753	3713790	-
	C642N	-	3713642
	C641D	-	3713809
	C753	-	3713790
3	Base plate screw (2)	3773421	3773421
4	Base plate	3753762	3753864
5	Tube assembly	3713766	3713766
6	"O" ring	3773461	3773461
7	Valve body	3723810	3723815
8	Gasket (2)	2779261	-
9	Nozzle screw	3753835	-
10	Electrical connector	-	3753865
11	Electrical connector	-	-
12	Electrical connector	-	-